APPENDIX N:

Risk Assessment for Risk-Based Cleanup of PCBs

APPENDIX N

RISK ASSESSMENT TO SUPPORT APPLICATION OF RISK-BASED CLEANUP OF PCBs

Note: This Risk Assessment is modified from the original risk assessment prepared in April 2016 to support the Immediate Response Action for RTN 3-33101. This risk assessment is modified to reflect the removal and off-site transport of the PCB hot spot soils and SP-1 stockpile soils; to evaluate the 0-3, 3-6 and 6-15 foot interval soils because the remediation of the 0-3 foot interval soils has already started; to support the planned and initiated (but put on hold) remediation, the risk for the sampling intervals based on original grade were evaluated; and to include additional analytical data collected since April 2016.

Asbestos is present in shallow soils. This risk assessment does not address the risks associated with asbestos exposure. An assumption is made that all asbestos-contaminated soils will be excavated and either transported off-site for appropriate disposal or placed in an on-Site soil repository.

This risk assessment uses the default values provided in MassDEP's Risk Assessment Guidance, associated Technical Updates and MassDEP's risk assessment ShortForms. Further, some default values were modified to reflect the presence of a protective cover over the soils of the courtyard and the limited potential for exposure now or in the future. A comparison of MassDEP's default values to USEPA's default values is provided within this document.

This risk assessment also provides the documentation supporting the development of the risk-based PCB cleanup standard for remediating PCB contamination at boring B-18, if the results of subsequent investigation determine it is necessary. The risk-based PCB cleanup standard for soils is derived to be 10 mg/kg total PCBs, as a 95th% upper confidence limit on the mean. A single soil sample maximum total PCB standard is 50 mg/kg.

The following risk assessment was prepared in accordance with the Massachusetts Contingency Plan (MCP), guidance provided by MassDEP in *Guidance for Disposal Site Risk Characterization in Support of the Massachusetts Contingency Plan* (updated in 1996), and subsequent technical updates. This risk assessment is an element of a Risk Characterization described at 310 CMR 40.0900. The purpose of this risk assessment is to determine what soil volumes within the courtyard are consistent with a finding of No Significant Risk of Harm (either with or without assumptions that would limit future uses or activities at the Site); and what soil

volumes within the courtyard have a finding of Significant Risk of harm and must be remediated. This risk assessment is being conducted to support decisions of the appropriate disposition of PCB-contaminated soils.

This risk assessment entails a site-specific assessment of the risk of harm to human health from exposure to courtyard soils. Exposure to other media (i.e., indoor air or groundwater) is unlikely to be factors, because: (1) the contaminants detected in the courtyard soils are generally not volatile; and (2) the depth to groundwater is more than 15 feet below grade based on monitoring well gauging conducted as part of a limited site investigation in August 2015. The PCB contamination is located above the water table; therefore, an impact to groundwater and the bordering Concord River is unlikely to occur. No Environmental Risk Characterization is needed for the PCB contamination.

This risk assessment is the same as a MCP Method 3 Human Health Risk Characterization, and relies on detailed information about the Site, the nature, magnitude and extent of OHM in each affected media, migration pathways of the OHM, and potential exposures to human receptors under all current and reasonably foreseeable Site activities and uses. This risk assessment excludes the asbestos contamination present in the shallow courtyard soils (mostly in the 0-3 foot interval). The 0-3 foot interval soils are contaminated with asbestos and, therefore, a Significant Risk of harm to human health is assumed to exist for the 0-3 foot interval soils because of the presence of asbestos alone. In the future during remediation, if any soils of the 3-6 foot interval are found to contain asbestos, they too would constitute a Significant Risk of harm to human health, regardless of the findings of this risk assessment.

Site and Receptor Information

Identification of Contaminants of Concern

According to the *Guidance for Disposal Site Risk Characterization*, chemicals detected at a disposal site should be considered contaminants of concern (COC) and should be carried throughout the risk assessment process unless one of the following conditions is true: (1) the chemicals are present at a low frequency of detection and in low concentrations; (2) the chemicals are present at levels consistent with background concentrations for the area and there is no evidence that their presence is related to activities at the site, or; (3) the chemicals are field or laboratory contaminants. Based on the results of the investigations conducted at the Site, soil is the media known or suspected to be impacted by oils or hazardous materials (OHM).

For the 0-15 foot interval, laboratory analyses were conducted only for soils. No groundwater was encountered within the top 15 feet of overburden. No indoor air sampling and analysis was conducted, because the contamination detected within the top 15 feet are not volatile (only very low levels of aromatic VOCs were detected). The soil analytical data considered in this

risk assessment are summarized in Table N-1 for all OHM except PCB congeners and in Tables N-6 to N-9; the data used in the risk characterization excludes that representative of the PCB-contaminated soils that were transported off-Site and that collected more than 15 feet below original grade. Soil is the only media of concern for this risk assessment.

For this risk characterization, the OHM detected in soils are evaluated and the soil COC are identified in Table N-1. PCBs, EPH subsets, PAHs, aromatic VOCs, metals and insecticides were detected in soils. During soil boring, coal ash, gasified coal and coal pieces were observed in the soil throughout the courtyard area. For metals and PAHs detected in soils, the MassDEP's background concentrations for soils associated with fill containing wood or coal ash were identified as appropriate for the Site. No published background concentrations exist for PCBs, EPH subsets, VOCs and insecticides; therefore, the background concentrations for these OHM are identified as zero.

The OHM detected in soils were evaluated to identify soil COC for the risk assessment, as documented in Table N-1. For metals and PAHs, this entailed comparing the maximum level detected to the applicable published background concentration.

The following metals were detected in one or more soil samples: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, thallium, vanadium and zinc. As documented in Table N-1, the following metals were detected at levels consistent with or less than MassDEP's published background concentrations: antimony, arsenic and cadmium. Mercury was detected in two of 20 soil samples, and only slightly above its published background concentration. Its presence is likely due to the prevalence of coal ash in the soils; mercury was eliminated as a soil COC. Thallium was only detected in one soil sample, which was collected from the sands in the FO-1 vault, at a level above its published background concentration. Thallium is eliminated as a soil COC for all exposure points and soil intervals, except for the FO-1 vault sands.

For chromium, the maximum concentration detected was 160 mg/kg in the soil sample from stockpile SP-1. No hexavalent (Cr VI) was detected (<4.9 mg/kg) in the soil sample from SP-1; therefore, Cr VI is not a soil COC. The chromium species is presumed represented by Cr III.

SVOCs that were detected included 17 PAHs and dibenzofuran. The PAHs are likely associated with the presence of coal ash, even though 16 PAHs were detected at levels above their published background concentrations. They were retained as soil COCs because in some samples the levels of PAHs were substantially above the published background concentrations. One PAH (i.e., acenaphthylene) was detected at levels below their published background concentrations for fill associated with soils containing coal ash or wood ash. However, acenaphthylene was retained as soil COC, because it is related to the other PAHs. Dibenzofuran is a constituent of the C11-C22 aromatic hydrocarbon subset of EPH; therefore, it is eliminated as a separate soil COC.

The three EPH subsets (C9-C18 aliphatic hydrocarbons, C19-C36 aliphatic hydrocarbons and C11-C22 aromatic hydrocarbons) were detected in the soil samples and are retained as soil COC. No VPH subsets were detected, and therefore no VPH subset is a soil COC. The only VOCs detected were benzene and toluene in soil samples collected from the gasoline UST tank grave. They were detected at very low concentrations (maximums of 0.15 and 0.60 mg/kg, respectively), but were retained as soil COC.

PCBs were detected in soils and are included as soil COC. Seventy-three soil samples were collected for analysis of PCBs, and PCBs were detected in fifty-three of the samples. The principal PCB mixture detected was Aroclor 1254. Seven samples contained another PCB mixture – Aroclor 1260 – in addition to Aroclor 1254. PCBs are identified as soil COCs.

Four soil samples were collected for analysis of PCB congeners (Tables N-6 to N-9). One soil sample contained a low concentration of total congener PCBs (0.025 mg/kg) and was eliminated from complete evaluation. USEPA's document, Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) & Dioxin-Like Compounds (EPA/100/R 10/005/ December 2010), identifies twelve TCDD dioxin-like PCB congeners. Of these twelve TCDD dioxin-like congeners, eight were detected in the soil samples (Table N-6). Combined, these eight TCDD dioxin-like PCB congeners comprise between 9.9 and 11% of the total PCB congeners (Table E-9). The eight TCDD dioxin-like PCBs were retained as COCs.

Tables N-1 and N-9 provides a list of the soil COC. The soil COC are also identified as COC for dusts.

Identification of Groundwater and Soil Categories

During a Method 3 Risk Characterization, soil and groundwater categories are identified to aid in the development of potential receptor exposure profiles and to identify applicable or suitably analogous standards as described in 310 CMR 40.0933(3).

Groundwater Categories

MCP groundwater categories are established by MassDEP for the characterization of risk at disposal sites; these categories describe the potential for different types of exposure. Appropriate groundwater categories are identified, based on site characteristics, site activity and use, and the nature and extent of the release, in accordance with the MCP (310 CMR 40.0932).

The groundwater categories describe the potential for three different types of exposure. Groundwater at all disposal sites shall be considered a potential source of discharge to surface water and shall be classified, at a minimum, as category GW-3 [310 CMR 40.0932(3)]. GW-2

groundwater is considered to be a potential source of vapors of OHM to indoor air [310 CMR 40.0932(6)]. GW-1 groundwater is considered a potential or actual supply of potable water [310 CMR 40.0932(4)].

A targeted file search was conducted to obtain information to assist in groundwater categorization. Based on a search of MassDEP's SearchWell Application database, fourteen domestic water supply wells exist in Lowell. They are identified below:

Lot 6 Dodge Road	35 Cannington Street	Lot 58 (address unknown)
537 School Street	62 Weston Avenue	Sheehan
346 Boylston Road	Route 133	358 Boylston Street
241 Pawtucket Boulevard (listed twice)	37 Second Avenue (listed twice)	1195 Varnum Avenue
Acropolis Road		

The only roads located within or slightly more than 500 feet from the Boiler House courtyard are the following: (1) Massmills Drive, (2) Bridge Street, (3) Stackpole Street, (4) Fayette Street, and (5) Brown Street. None of the active private potable drinking water wells are located on addressed on these roads, and, therefore, are not located within 500 feet of the Site. [http://public.dep.state.ma.us/searchwell/]

Based on the MassDEP Phase I Site Assessment Map (provided as Figure 3 in the original IRA Plan), the Site is not located within or near an Actual or Potential Drinking Water Source Area.

Based on monitoring well gauging conducted for courtyard monitoring wells in August 2015, depth to groundwater ranged between 19.9 and 22.7 feet below grade. This information is provided in the September 9, 2015 *Limited Site Investigation* report, prepared by GEC. Based on the available information, the following MCP groundwater categories are applicable to the site.

Groundwater Category	Yes	No	Criteria
1		**X**	Groundwater is within Zone II of a public water Supply well. If yes the groundwater is categorized as GW-1.
1		X	1a. Groundwater is within an Interim Wellhead Protection Area of a public water supply well.
			1b. A demonstration has been made that there is no hydrogeologic connection between the groundwater and the public water supply well.
		X	If the answer to 1a is yes, and to 1b is no, then the groundwater is categorized as GW-1.
1		X	1c. Groundwater is within an area designated by the MassDEP as a Potentially Productive Aquifer (PPA).
		X	1d. Groundwater is located within a medium or high yield aquifer, but has been designated by the MassDEP as a non-PPA, due to its urban or industrial character, but site inspection indicates that this assumption does not apply.
			1e. Site-specific information on the types/transmissivity of soils shows that the groundwater is not located within the true boundary of the medium or high yield aquifer.
			1f. The groundwater within the PPA is naturally brackish, or has naturally high levels of metals, such that the development of the aquifer is not technologically or economically feasible.
		X	If the answer to 1c or 1d is yes, and the answer to 1e or 1f is no, then groundwater is categorized GW-1.
1		**X**	Groundwater is within Zone A of Class A surface water body. If yes, the groundwater is classified as GW-1.
1		X	1g. Groundwater is located 500 feet or more from a public water system distribution pipeline.
	X		1h. The groundwater is located on a parcel of land or at a facility where any portion of that parcel or facility is located within 500 feet from a public water supply distribution pipeline.
		X	If the answer to 1g is yes, and to 1h is no, then groundwater is categorized GW-1.
1		X	1i. Groundwater is located within 500 feet of a private potable water supply well that was in use at the time of notification pursuant to 310 CMR 40.0300, and was installed in conformance with applicable laws, by-laws or regulations.
			1j. The private well(s) has been removed from service, and meets the conditions specified in 310 CMR 40.0932(d)(1).
			1k. It has been demonstrated that no hydrogeologic connection exists between the groundwater and private well(s).
		X	If the answer to 1i is yes, and to 1j or 1k is no, then the groundwater is classified as GW-1.
1		**X**	Groundwater is located within a locally designated Potential Drinking Water Source. If yes, then groundwater is categorized as GW-1.

Groundwater Category	Yes	No	Criteria
2	X		2a. Groundwater is located within 30 feet of an existing occupied building or structure
		X	2b. The annual average depth to groundwater in that area is 15 feet or less
		X	Do both 2a and 2b apply? If yes, the groundwater is categorized GW-2
3	**X**		Groundwater at all disposal sites is considered a potential source of discharge to surface water and is classified as GW-3

Soil Categories

MCP soil categories S-1, S-2, and S-3 describe a range of potential exposures to a particular volume of soil. Soil category S-1 is associated with the highest exposure potential, and category S-3 is associated with the lowest exposure potential. In this section, appropriate soil categories are identified for the site based on soil accessibility, intensity and frequency of use, and on the age groups of potential receptors.

The three soil categories describe a range of the potential for exposure to soil. Three criteria, defined below, are used to describe the exposure potential for the purposes of categorizing soil:

1) Frequency of use, which indicates how often a receptor makes use of, or has access to, the disposal site; high frequency for children is valid if children reside, attend school or attend day care at the disposal site, or if large numbers of children visit the disposal site; high frequency for adults is valid if adults reside at the disposal site, or work at the disposal site on a continuing basis;

2) Intensity of use, which describes the nature of the Site Activities and Uses that could potentially result in exposure to the receptor; high intensity activities include digging, gardening and recreational sports; passive activities, such as, walking, shopping and bird watching, are considered low intensity activities;

3) Accessibility of the soil to potential receptors, which is characterized as one of the following: "accessible"; "potentially accessible"; or "isolated" [310 CMR 40.0933].

Soil categories are assigned to specific volumes of soils. For current scenarios, the appropriate soil category for a specific soil volume is based on current site conditions, uses, and the age of the receptor. For future conditions, the soil category is assumed to be S-1 unless assumptions are used to limit future activities and uses. A matrix, which is used to select the appropriate current and future soil categories for each volume of soil on site, is provided below.

Receptor Characteristics

Access. Of Soil	Children Present				Adults Only Present			
	High Frequency		Low Frequency		High Frequency		Low Frequency	
	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity
AS	Category S-1			S-2	S-1	Category S-2		
PAS		Category S-2			S-2	Category S-3		
ISS	Category S-3							
* Category S-1 also applies to any accessible soil where current or reasonably foreseeable use of the soil is for growing fruits and vegetables for human consumption								

AS = Accessible (Surficial) Soil (0 to 3 feet deep, unpaved)
PAS = Potentially Accessible Soil (3 to 15 feet, unpaved; 0 to 15 feet, paved)
ISS = Isolated Subsurface Soils (greater than 15 feet or under the footprint of a building or permanent structure)

Historically, the property on which the courtyard is located was used for industrial and commercial purposes. Currently, the Picker Building is being renovated into a multi-family residential complex. Also, the Boiler House may be renovated into a multi-family residential complex in the future. The near-term plans for the courtyard include transforming it into a landscaped area to serve residents of the Picker Building. An assumption is made that a protective barrier (currently planned to be comprised of 3 feet of clean soils over a geotextile marker barrier) will be installed over the courtyard soils. This protective barrier will mitigate exposure by residents to contaminated soils, except potentially during a construction or utility repair project. Some of the more contaminated soils (currently stockpiled on-Site or located in the 0-3 foot interval) will be placed in on-Site isolate repositories before covering with the protective barrier.

Based on the above criteria for soil classification and the current and future site uses described above, a soil category was assigned to each volume of soil for both future and current conditions, as documented below. The appropriate soil category depends on property use, the location of the exposure point where the soil volume resides, the depth interval of the soil volume, and whether the soil volume is covered by pavement, building or other barrier. Each exposure point / depth interval combination is evaluated in the charts below.

Soil Categories for Current and Future Conditions
Current and Future Conditions: Boiler House Courtyard
Location: 169.2 Bridge Street
(Residential Use: All Soil Intervals)

Soil Volume	Receptor	Criteria	Comment	Soil Category
Potentially accessible or isolated subsurface soils (all soils covered with protective barrier) *	Child – Residential	Frequency	High – presumed to live at site	S-2
		Intensity	Low – soil disturbance activities are presumed not to occur under current or future conditions, except for construction / utility work	
		Gardening	Is not and will not occur	
Potentially accessible or isolated subsurface soils (all soils covered with protective barrier) *	Adult – Residential	Frequency	High – presumed to live at site	S-3
		Intensity	Low – soil disturbance activities are presumed not to occur under current or future conditions, except for construction / utility work	
		Gardening	Is not and will not occur	
Potentially accessible or isolated subsurface soils (all soils covered with protective barrier)*	Adult – Commercial	Frequency	High – presumed to work at site	S-3
		Intensity	Low – soil disturbance activities are presumed not to occur under current or future conditions, except for construction / utility work	
		Gardening	Is not and will not occur	
Potentially accessible or isolated subsurface soils (all soils covered with protective barrier)*	Adult – Utility / Construction	Frequency	Low – presumed to work at site only during a construction or utility project	S-3
		Intensity	High – soil disturbance activities are presumed to occur	
		Gardening	Is not and will not occur	

Soil volume	Soil Category
Current	S-2
Future	S-2

* An assumption is made that all soils of the Site will be covered with one or more protective barrier(s).

Soil and Groundwater Categories

In summary, the following categories apply to the soil and groundwater of the Site:

Media	Category	Location, Depth Interval and Comment
Groundwater	GW-3	Entire aquifer beneath the courtyard
Courtyard Soils	S-2	Presumed Current and Future Residential Conditions: All Soil Volumes (All soils covered with a protective barrier)
	S-3	Presumed Current and Future Commercial Conditions: All Soil Volumes (All soils covered with a protective barrier)
	S-3	Construction / Utility Work: All Soil Volumes (All soils covered with a protective barrier), except during construction / utility work

Note: The lowest soil category applicable to a soil volume, after considering all receptors and current and foreseeable uses, is provided. An assumption is made that gardening of edible produce will not occur in the future in the soils of the courtyard, except under Best Management Practices. For the courtyard, an assumption is made that future use could include multi-family residential, child school, daycare, institution, playground, active recreational, commercial, industrial or passive recreational use, but will not include single-family residences. In addition, for the exterior courtyard, all soils are presumed covered by protective barriers, except during a short-term construction project, which will be conducted under Site-specific Soil Management Plan, with provisions to mitigate residential exposure during the project. Some of the soils are presumed to be located within isolated on-Site repositories, located beneath the protective barrier. No future construction activities are presumed to be conducted in these areas, except under the direction of a Licensed Site Professional and an Asbestos Manager. Further, clean utility corridors are presumed created to house utility lines and to be maintained into the future. These assumptions require the implementation of a Notice of Activity and Use Limitation (AUL), a type of deed restriction. Because PCB levels greater than 1 mg/kg will remain on the property, under the Toxic Substance Control Act (TSCA), a deed restriction will be needed to provide notification to future owners or holders of record interest.

Potential Human Receptor Exposure Profiles

Human populations located at the property or on nearby properties include the following: (1) on-Site residents of a multi-family residential complex; (2) on-Site commercial workers; (3) on-Site construction workers; (4) on-Site utility workers; (5) on-Site customers / visitors / trespassers; (6) nearby residents; (7) nearby commercial workers; and (8) nearby customers / visitors / trespassers. Risks to on-Site and nearby customers / visitors / trespassers / commercial workers and nearby residents are believed to be adequately represented by on-Site residents. Children are typically considered the more sensitive receptor group; therefore, when calculating non-cancer risk, risk estimates were calculated for child residents and residents were presumed present for 30 years from age 1 to 31 years. Adult on-Site utility workers are believed adequately represented by on-Site

construction workers. Risk estimates were already calculated for construction workers, and the planned use of isolated repositories for the 0-1 and 1-3 foot interval soils to mitigate future exposure and risk to construction workers. This risk assessment targets the most sensitive receptors associated with residential exposure (High Occupancy), i.e., child / adult on-Site residents.

Currently, the adjoining Picker House lot is being developed for multi-family residential use. The Boiler House is currently vacant, but could be similarly developed in the future. The subject courtyard between the two buildings will be developed into green space for future residents. These uses are assumed to occur into the future. The courtyard is presumed covered with protective barriers (such as three feet of clean soil over a marker layer, hardscaping, pavement or a building foundation) and are assumed to remain so covered in the future.

During the risk characterization, assumptions were made that prohibit certain future uses and activities. For the exterior courtyard, future property use is presumed to not include single-family residences. It is also presumed to not include gardening of edible produce, except under Best Management Practices. A protective barrier is presumed to be maintained over the entire courtyard, because the entire courtyard contains PCB-contaminated soils. During excavation activities or other soil disturbance activities, soil management plans will be used to ensure proper handling of the soils and to mitigate potential exposures to residents and construction workers. Following excavation or soil disturbance activities, soils will be returned to the excavation or transported off-site in accordance with federal, state and local regulations; and the protective barrier will be replaced. All subsurface utilities will be located in clean utility corridors that are maintained in the future.

The exposure pathways or profiles for the target receptor group for current and reasonably foreseeable conditions are described below.

Current and Future On-Site Residents, including Children: Courtyard

This receptor is presumed to be a 1-31 year old female, who resides at a multi-family residential complex. Exposure to soils is presumed not to occur, except during a 6-month construction project, which occurs sometime during the period when the receptor is aged between 1 and 2 years. The receptor is presumed to weigh 10.7 kilograms (kg) during this period.

During the construction project, this receptor may be exposed to soil contamination via dermal contact and incidental ingestion, 2 days per week, for 26 weeks. Dermal contact is presumed to occur to face, hands, forearms, lower legs and feet. Incidental ingestion of soil is presumed to occur at a rate of 100 mg/day. More frequent exposure to soils is presumed limited by implementation of a soil management plan. During the construction project, inhalation of dusts is conservatively presumed to occur 24 hours per day, 7 days per week for 26 weeks. During the construction period, precautions identified in the Soil Management Plan are assumed implemented to limit the frequency of exposure.

No ingestion of home-grown edible produce is presumed to occur. Little to no volatile COC exist in the soils or groundwater is located more than 15 feet below grade; therefore, inhalation of vapors attributable to soil vapor intrusion is not an exposure pathway for the Site. No private or public water supply well is located near the Site or is likely to be located near the Site in the future; therefore, ingestion, dermal contact or inhalation of Site-related OHM in potable water is unlikely to occur.

Identification of Exposure Points

An exposure point is a location of potential contact between a human or environmental receptor and a release of OHM. Exposure points for applicable environmental media are identified in accordance with MCP guidance and regulations [310 CMR 40.0924].

Groundwater, Indoor Air and Construction Excavation Air

No human exposure points exist for groundwater, indoor air and construction excavation air.

Soils

The following soil exposure point is presumed to exist: (1) the Boiler House courtyard. The soils of the courtyard were evaluated to determine if a hot spot of PCB contamination exists. Since the soils of the B-11 hot spot were excavated, no other PCB hot spot has been identified (although future investigation will be conducted at B-18 to determine if it is a PCB hot spot). Based on earlier risk assessments, the 0-1 and 1-3 foot interval soils were known to constitute a Significant Risk of harm to human health, largely due to the presence of PCBs. The Immediate Response Action was designed to address these soils separately from the soils more than 3 feet below grade. Generally, the 3-6 foot interval soils had lower levels of PCBs than the 0-3 foot interval soils, and the 6-15 foot interval soils had lower levels and fewer detects of PCBs than did the 0-3 and 3-6 foot interval soils. Therefore, for this risk assessment, separate risk estimates were calculated for the 0-3, 3-6 and 6-15 foot interval soils. The 0-3 foot interval soils are presumed placed in on-Site isolated soil repositories, and covered with a 3-foot layer of clean soils with a marker layer. The repositories and clean layer of soils were not factored into deriving exposure point concentrations. A 3-foot layer of clean soils with a marker layer is also presumed placed over the 3-6 / 6-15 foot interval soils. This clean layer of soils was not factored into deriving exposure point concentrations. The vault sands were evaluated separately because they had soil COC concentrations that were different than the remaining soils. The soils of SP-2 are presumed to contain elevated levels of PCBs, and will either be removed from the Site or placed in an on-Site soil depository subject to a Notice of AUL. Similarly, the soils (i.e., some from the excavation of the gasoline USTs and some from the soils

overlying the no. 6 fuel oil vaults) used to backfill the gasoline tank graves are presumed to contain PCBs. These soils are presumed to either be removed from the Site or placed in an on-Site soil depository. The soils from SP-2 and the gasoline tank grave were considered representative of the original 0-3 foot interval and were included in the data set used to calculate exposure point concentrations for the 0-3 foot interval.

Based on the foregoing, the following four exposure points / soil intervals were evaluated in the risk assessment: (1) 0-3 foot interval courtyard soils; (2) 3-6 foot interval courtyard soils; (3) 6-15 foot interval courtyard soils; and (4) the vault sands (also called SP-3). The soil intervals are based on original grade in March 2016.

Dusts

For dusts in outdoor air, the exposure points are the on-Site exposure points. The soil samples, representative of exposure point concentrations at each soil exposure point, were used to calculate dust exposure point concentrations.

Identification of Exposure Point Concentrations

Except for TCDD dioxin-like PCB congeners, exposure point concentrations (EPCs) were calculated for each COC in soil for each exposure point and soil interval using measured values in collected samples (Tables N-2 to N-5). EPCs were calculated for TCDD dioxin-like PCB congeners, for input in the risk assessment as TCDD dioxin. The TCDD dioxin EPCs were calculated considering: (1) the EPCs for PCBs; (2) the portion of PCBs comprised of TCDD dioxin-like congeners (11%); and (3) the Toxicity Equivalence Factors (which was the same (3E-05) for all TCDD dioxin-like congeners detected at the Site), as documented in Tables N-6 to N-9. Note: Percent TCDD dioxin-like congener composition of PCBs was based on the congener PCB data. However, because congener PCB data was not available for most soil samples, the Aroclor PCB data was used to derive the TCDD dioxin-like PCB EPCs.

In addition, dust EPCs were estimated based on the use of a formula for air-borne particulates in ambient air. The approaches used to calculate EPCs for each COC in each environmental medium at each exposure point are described below.

The EPCs are determined consistent with Method 3 Risk Characterization, a chemical-specific approach, which estimates potential non-cancer and cancer risks for each receptor and compares these risks to MassDEP-identified risk limits. For soils and groundwater, the EPCs are the mean, 95th percentile upper confidence limit on the mean concentration, or maximum concentrations, dependent on the type of exposure, data variability, and amount of available data. As a conservative

measure, when calculating the mean or 95th percentile upper confidence limit, one-half the sample detection limit is used as a proxy concentration for samples in which a chemical was not detected.

For each COC in soils, the data sets were examined for each soil exposure point / exposure interval to determine the appropriate method to derive EPC, as documented in Tables N-2 to N-5. Except as identified below, for each OHM at each soil exposure point, the mean concentration was identified as the appropriate method to derive EPC for each COC, each exposure point and each soil interval.

Exposure Point	COC and EPC Method	Comment
All exposure points / soil intervals	PCB: 95th PUCL	human health risk assessment; 95th PUCL for PCB also used to derive TCDD dioxin EPC (to be consistent with TSCA, and, therefore, regardless of concentrations detected or data variability.)

Notes: 95th PUCL = 95th percentile upper confidence limit on the mean concentration

For dusts in outdoor air, EPCs are estimated assuming soil disturbance is occurring. The formula used is provided below. The soil EPCs are used to estimate dust EPCs. The soil EPCs are summarized in Tables N-2 to N-5 and N-9, and the dust EPCs are derived and summarized in the tables of Appendix N-1.

$$EPC_{air} = [OHM]_{soil} \times PF \times PM_{10} \times CF$$

Where:

EPC_{air} = Exposure Point Concentration for inhalation of particulates in air (mg/m^3_{air})

$[OHM]_{soil}$ = Soil concentration ($mg_{contaminant}/kg_{soil}$)

PM_{10} = Respirable particulate concentration in air (60 $\mu g/m^3_{air}$)

PF = Proportion of respirable particulate concentrations attributable to the site (0.50, unitless)

CF = Conversion factor (10^{-6} kg/mg)

Characterization of Risk of Harm to Human Health

Hazard Assessment

Extent of Oil and/or Hazardous Material

The hazardous materials (comprised of PCBs, metals, EPH, PAHs and pesticides) were detected from ground surface to approximately 15 feet below grade, with EPH and PAHs extending more than 15 feet below grade. For most contaminants except EPH, the highest levels of contamination were detected in the 0-3 foot interval soils and gradually declined with depth. The contaminated soils are located throughout the entire courtyard. Migration pathways include those typical of hazardous materials that are relatively non-volatile and tend to bind to soils. Dust generation, surficial run-off and tracking of soils are principal migration pathways. Leaching of contaminants is not expected to be a significant migration pathway, as determined by the decline in contaminant levels with depth and, for some metals (lead and cadmium), the lack of significant leachability based on TCLP testing. Volatilization to vadose zone air, indoor air and outdoor air is not a significant migration pathway. The OHM identified as soil COC are identified in Table N-1. The background conditions are also identified in Table N-1, and Site conditions are compared to background in Table N-1.

Toxicity Profiles

A descriptive summary of human health effects associated with each COC is available from MassDEP's *Documentation for the Risk Assessment ShortForm - Residential Scenario*, or from USEPA's *Integrated Risk Information System* (IRIS).

Dose-Response Values

The dose-response assessment relates the likelihood or severity of an adverse effect to the level of exposure. Dose-response values are provided for the following three categories: non-carcinogenic (threshold) health effects; carcinogenic (non-threshold) health effects; and relative absorption factors (RAFs), which are used to relate toxicity information identified in the literature to exposure pathways of concern at the disposal Site. Dose-response information for each COC is obtained from published literature describing epidemiological or toxicological studies. For each COC, dose-response values were obtained primarily from sources published by MassDEP and the United States Environmental Protection Agency (USEPA), i.e., the Integrated Risk Information System (IRIS) or the Health Effects Assessment Summary Tables (HEAST). The first source of dose-response values is MassDEP (i.e., toxicity values used by the MassDEP to develop MCP Method 1 Numerical Standards or provided in MassDEP's Risk Assessment Shortforms). The second source of dose-response values is USEPA's IRIS followed by USEPA's HEAST. For COCs that do not have dose-response values available through MassDEP, HEAST or IRIS, values were obtained from the USEPA's Superfund Health Risk Technical Support Center in Cincinnati, Ohio. RAFs were obtained from published sources of the MassDEP.

Non-carcinogenic Effects

For non-carcinogenic effects, a threshold is believed to exist below which a dose level or exposure level for a given OHM is not expected to result in an adverse health effect. As a result, a sub-threshold dose-response value, set in a conservative manner, would be expected to be protective of human health. Two types of sub-threshold values are Reference Doses (RfD) and Reference Concentrations (RfC). RfD is a sub-threshold dose in milligrams per kilogram body weight per day (mg/kg/day), at which daily exposure of a human population is likely to be free of adverse effects during a lifetime. RfC is an inhalation exposure concentration in milligrams or micrograms per cubic meter of air (mg/m^3 or $\mu g/m^3$), to which daily exposure of a human population is likely to be free of adverse effects. Wherever subchronic non-cancer dose-response values are not available, chronic dose-response values are used as surrogates. If RfC values were not available, a surrogate value was calculated via route-to-route extrapolation using the RfD.

Subchronic and chronic oral RfD values are provided in Appendix N-1. The sources of these values are identified on the same tables.

Carcinogenic Effects

For carcinogenic effects, no threshold dose is believed to exist which is associated with no risk. The USEPA evaluates available toxicity data and, based on this evaluation, chemicals are assigned to a weight-of-evidence class. The weight-of-evidence classification rates the likelihood that an agent is a human carcinogen. Three major factors are considered in characterizing the overall weight-of-evidence for carcinogenicity: (1) the quality of evidence from human studies; (2) the quality of evidence from animal studies; and (3) other supportive information, such as mutagenicity data and structure-activity data. Historically, the USEPA used Group A to E to identify weight-of-evidence carcinogenicity ratings. These groups are presented and defined below.

Weight-of-Evidence Category	Definition
Group A - Human Carcinogen	This category indicates there is sufficient evidence from epidemiological studies to support a causal association between an agent and human cancer
Group B - Probable Human Carcinogen	This category generally indicates there is at least limited evidence from epidemiologic studies of carcinogenicity to humans (Group B1) or that, in the absence of data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2)
Group C - Possible Human Carcinogen	This category indicates that there is limited evidence of carcinogenicity in animals in the absence of data on humans
Group D – Not Classified	This category indicates that the evidence for carcinogenicity in animals is inadequate, or no data are available
Group E – No Evidence of Carcinogenicity to Humans	This category indicates that there is evidence of non-carcinogenicity in at least two adequate animal tests in different species or in both epidemiologic and animal studies

More recently, as carcinogenicity is re-evaluated for a chemical, USEPA has dropped the use of group ratings and uses descriptors instead. Gradually with time, more chemicals are receiving descriptor ratings. Some chemicals descriptors are dose or route dependent. The five descriptors are as follows: (1) carcinogenic to humans; (2) likely to be carcinogenic to humans; (3) suggestive evidence of carcinogenic potential; (4) inadequate information to assess carcinogenic potential; and (5) not likely to be carcinogenic to humans. The carcinogenic potential for each COC is described based on its current description within IRIS.

Cancer Slope Factors (CSFs) and Unit Risks (URs) are the relevant toxicity criteria for assessing cancer risks. CSFs and URs are typically calculated for chemicals in Groups A, B1, and B2, and occasionally calculated for chemicals in Group C. The oral CSF is the largest possible linear slope, within the upper 95% Confidence Limit, expressed as the risk per unit dose, and is typically given in units of $(mg/kg/day)^{-1}$. The inhalation UR is the upper 95% Confidence Limit of the mean incremental lifetime cancer risk estimated to result from lifetime exposure to an agent if it is in the air at a concentration of 1 $\mu g/m^3$ or in the drinking water at a concentration of 1 µg/L. Use of the CSF or UR assumes that the estimated dose received by a receptor is expressed as a lifetime average.

The following COC detected at the Site are listed as carcinogens: (1) nickel (inhalation only) and benzene, which are Class A carcinogens; (2) beryllium and cadmium, which are Class B1 carcinogens via the inhalation route; and (3) benzo(a)anthracene, benzo(a)pyrene,

benzo(b)fluoranthene, benzo(k)fluoranthene, chlordane, chrysene, DDD, DDE, DDT, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, dieldrin, dioxin (TCDD equivalents), lead and PCBs, which are Class B2 carcinogens. The TCDD toxicity equivalent PCBs are also carcinogens. The remaining COC are either listed as Class D or insufficient data is available on their carcinogenicity.

For nickel, beryllium and cadmium, inhalation URs are derived, but the oral CSFs are not available. For lead, too many uncertainties exist in the cancer studies to derive oral CSF or inhalation UR; therefore, lead was not included as a cancer COC. The oral CSFs and inhalation URs for each of the carcinogenic COC are provided in Appendix N-1.

Relative Absorption Factors (RAFs)

The RAF is used to account for differences in the absorption efficiency under exposure conditions for the site compared to the absorption efficiency for the study used to develop the associated dose-response value. RAFs used in the Risk Characterization are values provided in MassDEP's excel Toxicity workbook for deriving MCP Method 1 Numerical Standards or in MassDEP's Risk Assessment ShortForms. RAF's for non-cancer and cancer COC are provided in Appendix N-1.

Permeability Coefficients (K_p)

The K_p is a value used to estimate the rate of transfer of a chemical through the skin. K_p's used in the Risk Characterization are values provided in MassDEP's excel Toxicity workbook for deriving MCP Method 1 Numerical Standards or in MassDEP's Risk Assessment ShortForms.. No K_p were used for this risk characterization.

Exposure Assessment

Development of Exposure Profiles

Exposure profiles are provided in the section entitled "Potential Human Receptor Exposure Profiles," above. These profiles were developed considering current and reasonably foreseeable activities and uses of the Site.

Quantitative Estimation of Exposure

Once exposure profiles are developed describing the COC, exposure points, and the receptors of concern, the potential exposures experienced by the receptors are quantified. The quantitative exposure estimates are then used to estimate risk, as described below.

The types of exposure or dose used to characterize risk depend on the exposure pathway under evaluation and the nature of the toxicity information available for each chemical. The Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD), in units of mg/kg/day, are calculated to estimate non-cancer and cancer effects from exposure to COC via incidental ingestion and dermal contact pathways. The Average Daily Exposure (ADE) and Lifetime Average Daily Exposure (LADE) are calculated and used when estimating non-cancer and cancer effects from exposure to COC via inhalation.

Estimates of exposure are provided in tables contained within Appendix N-1 for Residents. These same tables provide the equations and exposure factors used to calculate exposure estimates.

Calculation of Risks

Chronic and Subchronic Non-Cancer Risk: The measure used to describe the potential for non-cancer health effects is the Hazard Index (HI). For a given chemical the HI is the ratio of a receptor's exposure level (or dose) to the "allowable" exposure level. A Hazard Index of 1.0 or less indicates that the receptor's exposure is equal to or less than the allowable exposure level, and it is considered unlikely that adverse health effects will occur. For a given route of exposure HIs are calculated as follows:

$$HI_{route\text{-}specific} = (E_1/Rf_1) + (E_2/Rf_2) + \ldots + (E_i/Rf_i)$$

Where:

E_i = Non-cancer exposure intake or concentration for the i^{th} chemical; and

Rf_i = RfD (oral) or RfC (inhalation) for the i^{th} chemical.

Route-specific HIs are added to obtain a cumulative non-cancer HI for each receptor group and exposure point. The cumulative non-cancer HI for each receptor is compared to MassDEP's cumulative non-cancer risk limit, which is a Hazard Index of 1.0.

Subchronic HIs were calculated for both receptors, because exposure is presumed to occur for relatively short periods of time, such as during a one week utility repair project or during a six-month construction project. For each COC-receptor-exposure point combination, HIs are calculated in tables provided in Appendix N-1. For each receptor, the total cumulative HIs are compared to MassDEP's non-cancer risk limit of 1.0 in Table N-10.

Cancer Risk: The potential for carcinogenic (i.e., non-threshold) health effects is characterized as the Excess Lifetime Cancer Risk (ELCR). The ELCR represents the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. For a

given chemical, the estimated ELCR is the product of the receptor's quantified exposure and a measure of carcinogenic potency (i.e., cancer slope factor or unit risk factor). For a given route of exposure, the ELCR is calculated as follows:

$$ELCR_{route\text{-}specific} = (EI_1 \times SF_1) + (EI_2 \times SF_2) + \ldots + (EI_i \times SF_i)$$

Where:

EI_i = Cancer exposure intake or concentration for the i^{th} chemical; and

SF_i = Slope Factor for the i^{th} chemical.

Route-specific ELCRs are added to obtain a cumulative ELCR for each receptor group and exposure point. The cumulative ELCR for each receptor will be compared to MassDEP's cumulative cancer risk limit, which is an ELCR equal to one-in-one hundred thousand (1×10^{-5}).

For each COC-receptor-exposure point combination, ELCRs are calculated in tables provided in Appendix N-1. For each receptor, the total cumulative ELCR is compared to MassDEP's cancer risk of one-in-one hundred thousand (1×10^{-5}) in Table N-10.

Identification of Applicable and/or Suitably Analogous Public Health Standards

The MCP requires that the characterization of risk of harm to human health include a comparison of Site conditions to applicable or suitably analogous public health standards. No applicable or suitably analogous public health standards exist for the Site.

Characterization of Risk of Harm to Human Health

Risk of Subchronic and Chronic Threshold (Non-Carcinogenic) Health Effects: For each receptor group, the total cumulative subchronic or chronic HI is compared to MassDEP's cumulative non-cancer risk limit of 1.0. Subchronic HI were calculated for resident and construction worker. Limits on future exposure to residents, entailing the maintenance of a protective barrier over soils were assumed. No chronic HI were calculated, because no chronic exposure exists under current and presumed conditions. The results of the non-cancer risk assessments are summarized in Appendix N-1 for residents. The cumulative HIs are compared to the non-cancer risk limit in Table N-10.

Based on these findings, No Significant non-cancer Risk of harm exists for the 3-6 and 3-15 foot interval courtyard soils for both receptors, presuming that a protective barrier is maintained over the soils of the courtyard and a Soil Management Plan that contains provisions to mitigate the potential for residential exposure during a future construction project is implemented. For the 0-3

foot interval soils and vault sands (SP-3), Significant Risk of harm exists for residents. The principal drivers of the non-cancer risks are PCBs, dioxin (TCDD equivalence) and lead.

Risk of Non-Threshold (Carcinogenic) Health Effects: For each receptor group, the total cumulative ELCR is compared to MassDEP's cumulative cancer risk limit of 1E-05. ELCRs were calculated for resident, commercial worker and construction worker. Limits on future exposure to residents, entailing the maintenance of a protective barrier over soils and implementation of a soil management plan during future construction or utility work, were assumed. The results of the cancer risk assessments are summarized in Appendix N-1 for residents. A comparison of the cumulative ELCRs to the cancer risk limit is provided in Table N-10.

Based on these findings, No Significant cancer Risk of harm exists for residents for all exposure points/soil intervals. The principal contributor to the cancer risk estimates is PCBs, with significant contribution from dioxin (TCDD equivalence).

Comparison of Site Conditions to Applicable or Suitably Analogous Public Health Standards: No applicable or suitably analogous public health standards were identified for the Site.

Uncertainty Analysis

Uncertainty is inherent in the risk assessment process, which includes a variety of scientific judgments. In general, during the course of a risk characterization, conservative assumptions or decisions are made in order to minimize the possibility that uncertainty would result in a false indication of no significant risk of harm. Uncertainties specific to this risk assessment are provided below.

Site Characterization: Uncertainties relating to the adequacy of Site characterization, including the sampling plan and analytical data, always exist, but can be minimized with a carefully planned field investigation. In general, conservative assumptions were made throughout the risk characterization, to account for limitations in Site data.

No directly measured levels of particulate-bound OHM (dusts) in ambient air were obtained. It was not possible to obtain these data, because current site conditions are not consistent with the evaluated exposure pathway. Equations with conservative input values were used to provide estimates of OHM as dusts.

Assumptions concerning the frequency, duration, and magnitude of receptor exposures: Either means, 95th percentile upper confidence limits on the mean or mean concentrations were used to obtain estimates of EPCs. 95th Percentile upper confidence limits on the mean were used when significant data variability exists for a specific exposure point and media, or where a limited amount

of data is available. Exposure factors were either provided in MassDEP's Construction Worker ShortForm or were generally consistent with those used in MassDEP's documentation for developing Method 1 Standards, or recommended by MassDEP in its *Guidance Document for Disposal Site Risk Characterization* and related Technical Updates. However, because a protective barrier is assumed to be present, some of the exposure factors for on-Site resident assumed exposure would not occur except during a six-month construction project.

Availability and accuracy of the toxicity data: The development of dose-response values and relative absorption factors has uncertainties dependent on the amount of quality toxicity data available for the chemical. However, dose-response values that were derived, recommended or provided by MassDEP were used in this risk characterization.

Risk Characterization Conclusions

Conclusions Regarding Risk of Harm to Human Health and Conditions for Notice of Activity and Use Limitation

Risk of harm to human health was characterized for the Site via a MCP Method 3 Human Health Risk Characterization. Assumptions limiting future activities or uses of the Site were considered during the course of the risk characterization.

The total cumulative HIs for residents were less than MCP's Method 3 non-cancer risk limit for the 3-6 and 3-15 foot intervals. The total cumulative HIs for residents were more than the MCP's Method 3 non-cancer risk limit for the 0-3 foot interval soils and the vault soils (SP-3). The total cumulative ELCR for residents for all exposure points and soil intervals were less than the MCP's Method 3 cancer risk limit. These findings presume that a protective barrier is maintained over the soils of the courtyard and that controls are implemented under a Soil Management Plan during a future construction project to mitigate residential exposures. The principal risk driver is PCB, followed by TCDD equivalence and lead.

Based on these findings the 0-3 foot interval soils and the vault soils (SP-3) need to be remediated to achieve No Significant Risk of harm. Assumptions were already made that the SP-2 stockpiles will be remediated, as well as the soils used to backfill the gasoline tank graves. This remediation is assumed to entail excavation of these soils and placement in on-Site isolated soil repositories and covering the repositories with a protective barrier, currently planned to consist of three feet of clean soil and a marker barrier. If insufficient storage capacity is available for these soils, the remainder will be transported off-site to a hazardous waste facility approved to accept PCB waste (up to 50 mg/kg) and asbestos.

For the soils located more than 3 feet below grade, excavation is not required (except to address the no. 6 fuel oil contamination on the eastern portion of the courtyard). However, the soils should be covered with a protective barrier, currently planned to consist of three feet of clean soil and a marker barrier. Clean utility corridors will be conducted to separate subsurface utility lines from PCB-contaminated soils and to allow for emergency utility repair.

If the soils identified above are remediated, No Significant Risk of harm to human health will be achieved for the courtyard, assuming some limits on future activities and uses. Gardening of edible produce is presumed not to be conducted within the disposal site boundaries through Best Management Practices. Certain limits will require the implementation of a Notice of AUL, which is more restrictive to reflect both TSCA, MCP and asbestos regulatory requirements:

1. Passive recreational use of the courtyard is allowed. Landscaping and hardscaping is allowed, so long as the original grade of the protective barrier is maintained. No bushes or trees may be planted in the protective barrier, but may be planted in containers set on the protective barrier. All other uses, including driving vehicles (excepting that needed for landscaping, maintenance or emergency response) over the protective barrier, are prohibited.
2. The on-Site isolated soil repositories located in the courtyard will be maintained, such that these soils remain segregated from the surrounding soils. [The use of isolate repositories beneath the protective barrier along with specific conditions of the Notice of AUL will result in no human exposure and hence No Significant Risk of harm.]
3. A protective barrier will be maintained over the soils of the courtyard, including the isolated soil repositories. Periodic inspection and maintenance of the protective barrier will be conducted at least annually and also after utility repair work is conducted.
4. An LSP must be notified when planning future construction, other soil excavation or soil disturbance activities within the protective barrier, to evaluate the role of TSCA, MCP and asbestos regulations on the project and the potential for impact on the protective barrier.
5. Future excavation or disturbance of all soils beneath the protective barrier (including in the repositories) is prohibited, unless a Licensed Site Professional and Asbestos Manager first evaluate the project relative to TSCA, the MCP and the regulations, and unless the USEPA's PCB Coordinator, the MassDEP Bureau of Waste Site Cleanup and MassDEP Bureau of Air and Waste (Asbestos Program) are first notified.
6. All subsurface utility lines must be placed in clean utility corridors that are maintained into the future. A Soil Management Plan for emergency and non-emergency utility repair must be maintained on-Site and used during utility repair projects. For non-emergency utility repair projects, a Licensed Site Professional must be notified prior to starting the utility repair project. For emergency utility repair projects, a Licensed Site Professional must be notified as soon as practical. Following the completion of each emergency or non-emergency utility

repair, the clean corridor must be inspected and repaired as needed. The protective barrier must be placed back over the clean utility corridor.

7. Language will be provided in the Notice of AUL providing notice of the presence of PCBs and asbestos in the isolated soil repositories and PCBs in the soils below the protective barrier.

   A risk-based PCB cleanup standard has been developed using the exposure point concentrations for the 3-6 foot interval and by adjusting the PCB and TCDD exposure point concentrations. The risk-based PCB cleanup standard is 10 mg/kg and is assumed to be the exposure point concentration (i.e., 95th% upper confidence limit on the mean). A second PCB cleanup standard applies to individual samples. No sample can contain more than 50 mg/kg. These cleanup standards will be used, as needed for boring B-18 area, to determine the following:

   (1) Whether any PCB-contaminated soils need to be transported off-site (>50 mg/kg PCBs in any soil sample);
   (2) Which PCB-contaminated soils must be placed in on-Site isolated soil repositories or, if insufficient on-site repository storage is available, must be transported off-site (<50 mg/kg PCBs in any soil sample and >10 mg/kg PCBs as an exposure point concentration).
   (3) Which PCB-contaminated soils may remain beneath the protective barrier but does not have to be placed in an isolated repository (<50 mg/kg PCBs in any soil sample and no more than 10 mg/kg PCBs as an exposure point concentration).

USEPA Region I is requiring additional investigation surrounding boring B-18, due to the presence of an elevated PCB level in the 0-5 foot interval soil sample collected from this location. These cleanup standards should be used to evaluate whether any of the soils surrounding B-18 must be transported off-site or can be placed in the repositories. On-site soil repositories that have already been used are the modified coal chute and four dry wells located in the courtyard. Potential repositories include the utility vault located in the northwest corner of the courtyard and, following excavation of the petroleum-contaminated soils, the FO-1/FO-2 vault areas in the east portion of the courtyard.

Comparison of USEPA and MassDEP Default Assumptions used in Risk Assessments

MassDEP's risk assessment guidance is similar to EPA's RA Guidance for Superfund, Volume I Part A. As pertains to the risk assessment contained in the RAM Plan Modification, some key differences between the two guidance documents are described below:

i. MassDEP requires an appropriately conservative estimate of mean concentration for use as the exposure point concentration. Depending on the data set, the exposure point concentration may be a mean concentration, maximum concentration or 95% upper confidence limit (UCL) on the mean. EPA's guidance requires the use of the 95% UCL on the mean. For this risk assessment, the 95% UCL of the mean was used for PCBs and TCDD. For the remaining contaminants of concern, the mean concentration was used. These remaining contaminants of concern were detected at relatively low concentrations and their presence, even at 95% UCL of the mean, would not significantly change the outcome of the risk assessment.

ii. The risk assessment used cancer and non-cancer dose response values required by MassDEP. Usually, MassDEP adopts EPA's dose response values provided in the Integrated Risk Information System (IRIS). When they do not adopt EPA's dose response values, they usually derive or identify one that is more conservative than EPA's. When EPA does not provide a dose response value, MassDEP derives its own, which is more conservative than eliminating a contaminant from an exposure pathway in the quantitative risk assessment.

iii. The differences between the exposure factors used in this MCP Method 3 Human Health Risk Characterization are compared to those used in TSCA Human Health Risk Assessments. Most of the EPA exposure factors are provided in EPA's Exposure Factors Handbook (2011) [http://www.epa.gov/ncea/efh/pdfs/efh-complete.pdf].

   a. In Table N-11, the exposure factors used in this risk characterization are compared to those in EPA's *Exposure Factors Handbook* and EPA's *Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Volumes A, E and F)* (RAGS). Regarding EPA's example comparison above, the RME for exposed skin of 5700 cm^2/day is for all adult residents (RAGS Part E, page 3-10). The risk characterization assumed that the soils remain in an isolated soil repository and/or covered by a protective barrier, and that residential exposure occurs only during a single six-month period when the protective barrier is removed. As such, a conservative assumption was made that the most sensitive receptor (a very young child) would be exposed to the soils during this period. Therefore, the adult surface RME for exposed skin of an adult resident does not apply.

   b. The risk assessment provided in the RAM Plan Modification assumed the exposure period for each receptor would be limited to a six-month period during which a

construction project was occurring. However, a six-month exposure period is unlikely to occur because a protective barrier/isolate soil repository will be installed over the courtyard soils, utility lines will be placed in clean utility corridors, and future utility repair work must be conducted under a Soil Management Plan. The requirements for maintenance and activities pertaining to the protective barrier and isolate soil repositories would be memorialized via a deed restriction (i.e., a Notice of Activity and Use Limitation). Therefore, the risk assessment contained site-specific exposure factors for exposure period, exposure duration, non-cancer averaging period and, for resident, exposure frequency. These site-specific exposure factors are consistent with the requirements of the Notice of Activity and Use Limitation.

c. The following MassDEP and EPA exposure factors were compared for the resident receptor. EPA provides default exposure factors for residents. When there are no restrictions on exposure, both MassDEP's and EPA's defaults are that a resident resides at the same location for 30 years, from age 1 to 31 years. For this risk assessment, because exposure is presumed to occur only during a 6-month period, the residential receptor was conservatively assumed to be aged 1 to 2 years old during the period of exposure. This assumption would tend to result in a higher exposure and risk estimate than if the resident was assumed to be older.

d. Given the use of the protective barrier, isolated soil repositories and Notice of Activity and Use Limitation, the comparison of MassDEP's and EPA's exposure factors is most significant for skin surface area (SA), soil adherence factor (AF), soil ingestion rate (IR), body weight (BW), dust inhalation rate (Inh) and chemical-specific oral and dermal absorption factors. These comparisons are documented in Table N-11 for all except the absorption factors, which is documented in Table N-12.

e. Resident: The EPA documents provided guidance on a resident, aged 1 to 6 years old, who has a body weight (BW) of 15 kg, IR) of 100 mg/day (or 200 mg/day, if aged 3 to 6 years old), a skin surface area (SA) of 2800 cm^2/day and AF of 0.2. Because a protective barrier would be in place and exposure would be limited to a single six-month project, GEC assumed the resident would be aged 1-2 years at the time of exposure. [Actually, penetration of the protective barrier would not be allowed, except under the oversight of a Licensed Site Professional and Asbestos Manager and under regulatory control of TSCA, the MCP and Massachusetts asbestos regulations.] This child resident has a BW of 10.7 kg, an IR of 100 mg/day, a SA of 1670 cm^2/day and an AF of 0.35. GEC's use of the lower SA is consistent with that of a younger and smaller child, with a lower BW. Based on the ratio of

SA/BW, GEC's approach would result in a 15.6% lower risk estimate for dermal contact exposure than if EPA's BW and SA values were used. However, this decrease is offset by the use MassDEP's higher AF value, which would result in a 17.5% higher risk estimate for dermal exposure. The IR/BW suggests a 40% higher risk estimate for ingestion of soils from using MassDEP's assumptions. For this receptor, the direct contact soil exposure frequency (EF) was assumed to be 2 days per week rather than 5-days per week, because a soil management plan would be used to limit residential exposure to soils via direct contact. The EF for exposure to dusts was assumed to be 24 hours per day, 7 days per week during the 26-month construction project. Although dust suppression or monitoring activities will be conducted during the Risk-Based Cleanup of PCBs/Immediate Response Action/ Release Abatement Measure, it was not used to limit the assumed residential child exposure to dusts. The net result of these differences is an appropriately conservative estimate of exposure, given the planned installation and maintenance of the protective barrier and isolate soil repositories and the planned implementation of a Notice of Activity and Use Limitation and use of a soil management plan during any period of soil disturbance.

f. Soil Dermal Absorption Factors: The MassDEP's and EPA's soil absorption factors were compared for the dermal contact exposure routes. MassDEP provides soil absorption factors for all contaminants of concern for this Site. EPA provides a soil absorption factor for only one contaminant of concern (PCB-1254/1242). MassDEP's higher absorption factor (0.16) would result in a 14.3% higher risk estimate for dermal exposure than would EPA's absorption factor (0.14). MassDEP also provides a recommended default absorption factor for semi-volatile organic compounds that have no dedicated absorption factor of their own. For C19-C36 aliphatic hydrocarbons and C11-C22 aromatic hydrocarbons, MADEP's dermal absorption factors are 0.1 and 0.18, respectively. For C11-C22 aromatic hydrocarbons, the use of MassDEP's higher absorption factor would result in an 80% higher estimate of dermal exposure than if EPA's default absorption factor was used. When no dedicated or default exposure factor exists for a contaminant, EPA recommends qualitatively evaluating the contaminant for dermal exposure in the uncertainty section of the risk assessment in lieu of including it in the quantitative risk assessment. MassDEP provides dermal soil absorption factors and requires evaluating them in the quantitative risk assessment. Excluding them from the

quantitative risk assessment would decrease the risk estimate, potentially significantly. EPA does not provide soil dermal absorption factors for the metals.

g. Soil Ingestion (Gastrointestinal (GI)) Absorption Factors: The MassDEP provides soil oral absorption factors for each contaminant of concern. EPA does not provide specific soil oral absorption factors, but does provide GI absorption factors for most of the contaminants of concern. For most contaminants with absorption factors, MassDEP's soil absorption factors are higher than EPA's GI absorption factors, which indicate that the use of MassDEP's soil absorption factors would result in higher estimates of exposure (thus risk) by the ingestion pathway. For PCBs, which is the primary risk driver, MassDEP's soil absorption factor (0.85) lies between the values provided by EPA (ranging from 0.80 to 1.0).

h. Results: Based on these comparisons, the human health risk characterization documented herein provides an appropriately conservative estimate of exposure, comparable to or more conservative than if EPA's exposure assumptions were used. This finding takes into account the site-specific decision to install and maintain a protective barrier and/or to place soils in isolated soil repositories. Occasional access is assumed to occur; however, the Notice of AUL prohibits accessing the PCB-contaminated soils, except under the oversight of an LSP and Asbestos Manager and after proper notification of the EPA Region I PCB Coordinator, MassDEP Bureau of Waste Site Cleanup and MassDEP Bureau of Air and Waste.

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	Background	SAMPLING LOCATION														
	Soils assoc. with Fill	B-1 (15'-20')	B-3 (15'-20')	B-3 (15'-20') (25-	B-4 (15'-20')	B-4 (15'-20') (21-	B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-5 (3-6')	B-5 (6-11')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-7 (3-6')	B-7 (6-11')
Sampling Date	Containing	8/14/2015	8/14/2015	8/14/2015	8/14/2015	8/14/2015	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016
Sample Depth Relative to Original Grade on March 2016		15-20 Feet	15-20 Feet	15-20 Feet	15-20 Feet	15-20 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet
Sample Depth During Investigative Event	Coal Ash or Wood Ash	15-20 Feet	15-20 Feet	15-20 Feet	15-20 Feet	15-20 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet
Sample Depth Relative to October 1, 2016		12-17 Feet	14-19 Feet	14-19 Feet	12-17 Feet	12-17 Feet	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	0-3 Feet	3-8 Feet	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	0-3 Feet	3-8 Feet
NOTES:				13		13	11	11	11			11	11	10, 11		
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS		810	48		570				24	26	300			61	ND (11)	ND (22)
C19-C36 ALIPHATICS		1700	77		1200				160	64	750			140	28	48
C11-C22 AROMATICS		**3400**	200		**3600**				310	220	**1400**			180	83	83
ACENAPHTHENE	2	ND (0.22)	0.22		ND (0.22)				1.4	0.76	ND (0.49)			*2.6*	0.54	ND (0.22)
ACENAPHTHYLENE	1	ND (0.22)	ND (0.11)		ND (0.22)				0.37	0.11	ND (0.49)			0.38	ND (0.11)	ND (0.22)
ANTHRACENE	4	1.9	0.65		5.4				3.4	1.8	ND (0.49)			*5.4*	1.4	0.29
BENZO(A)ANTHRACENE	9	3.0	1.1		**7.4**				**7.4**	4.1	ND (0.49)			***11***	2.9	1.2
BENZO(A)PYRENE	7	ND (0.22)	0.88		**5.5**				**6.5**	**3.7**	ND (0.49)			***9.3***	**2.4**	1.1
BENZO(B)FLUORANTHENE	8	ND (0.22)	1.2		**7.1**				***9.1***	5.3	ND (0.49)			***12***	3.3	1.3
BENZO(G,H,I)PERYLENE	3	ND (0.22)	0.58		1.5				*3.4*	1.7	ND (0.49)			*5.0*	1.2	0.66
BENZO(K)FLUORANTHENE	4	ND (0.22)	0.43		2.5				3.0	2.0	ND (0.49)			*4.6*	1.2	0.52
CHRYSENE	7	3.8	1.2		*7.8*				*8.5*	5.0	ND (0.49)			*12*	3.2	1.3
DIBENZ(A,H)ANTHRACENE	1	ND (0.22)	ND (0.11)		ND (0.22)				***1.1***	0.65	ND (0.49)			***1.7***	0.41	ND (0.22)
FLUORANTHENE	10	3.5	2.3		*15*				*18*	9.5	1.2			*26*	6.6	2.3
FLUORENE	2	*3.5*	0.44		*6.9*				1.9	0.90	ND (0.49)			*3.4*	0.78	ND (0.22)
INDENO(1,2,3-CD)PYRENE	3	ND (0.22)	0.51		2.6				*4.1*	2.1	ND (0.49)			*5.1*	1.3	0.56
2-METHYLNAPHTHALENE	1	0.49	ND (0.11)		***3.1***				0.67	0.29	0.70			0.96	0.22	ND (0.22)
NAPHTHALENE	1	*1.3*	0.12		*2.1*				*1.7*	0.44	0.79			*1.5*	0.32	ND (0.22)
PHENANTHRENE	20	5.3	1.9		***21***				15	7.4	1.6			*23*	6.1	1.2
PYRENE	20	2.6	2.3		13				17	8.8	ND (0.49)			*22*	5.9	2.4
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)																
DIBENZOFURAN (see notes 7, 9)																
DI-N-BUTYLPHTHALATE (see note 7)																
MADEP-VPH-04-1.1 (mg/Kg dry)																
C5-C8 ALIPHATICS		ND (29)	ND (12)		ND (44)											
C9-C12 ALIPHATICS		ND (29)	ND (12)		ND (44)											
C9-C10 AROMATICS		84	51		100											
BENZENE		0.26	ND (0.062)		0.52											
ETHYLBENZENE		ND (0.14)	ND (0.062)		ND (0.22)											
METHYL TERT-BUTYL ETHER (MTBE)		ND (0.14)	ND (0.062)		ND (0.22)											
NAPHTHALENE	1	ND (0.72)	ND (0.31)		ND (1.1)											
TOLUENE		ND (0.14)	ND (0.062)		0.32											
M/P-XYLENE		ND (0.29)	ND (0.12)		ND (0.44)											
O-XYLENE		ND (0.14)	ND (0.062)		ND (0.22)											

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	Background	SAMPLING LOCATION														
	Soils assoc. with Fill	B-1 (15'-20')	B-3 (15'-20')	B-3 (15'-20') (25-	B-4 (15'-20')	B-4 (15'-20') (21-	B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-5 (3-6')	B-5 (6-11')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-7 (3-6')	B-7 (6-11')
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
ANTIMONY	7								ND (2.7)					ND (2.8)		
ARSENIC	20								11					13		
BARIUM	50								*120*					*91*		
BERYLLIUM	0.9								*1.4*					*1.3*		
CADMIUM	3								0.89					1.2		
CHROMIUM (as +3)	40								34					*50*		
LEAD	600								100					150		
NICKEL	30								29					26		
SELENIUM	1								ND (5.4)					ND (5.7)		
SILVER	5								ND (0.54)					ND (0.57)		
THALLIUM	5								ND (2.7)					ND (2.8)		
VANADIUM	30								*110*	*55*	30			*66*	*31*	14
ZINC	300								200					260		
SW-846 7471B (mg/Kg dry) Metals Digestion																
MERCURY	1								0.16					0.38		
SW-846 7196A (mg/Kg dry)																
CHROMIUM +6	40															
SW-846 8082A (mg/Kg dry)																
PCB 1016							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1221							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1232							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1242							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1248							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1254							**7.0**	**3.7**		**3.8**	0.29	**8.5**	**6.0**		**2.2**	ND (0.11)
PCB 1260							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1262							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
PCB 1268							ND (1.1) *	ND (0.56)		ND (0.57)	ND (0.12)	ND (1.1) *	ND (1.1) *		ND (0.55)	ND (0.11)
TOTAL PCBs							**7.0**	**3.7**		**3.8**	0.29	**8.5**	**6.0**		**2.2**	ND (0.11)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	Background	SAMPLING LOCATION														
	Soils assoc. with Fill	B-1 (15'-20')	B-3 (15'-20')	B-3 (15'-20') (25-	B-4 (15'-20')	B-4 (15'-20') (21-	B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-5 (3-6')	B-5 (6-11')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-7 (3-6')	B-7 (6-11')
SW-846 8081B (mg/Kg dry)																
ALDRIN									ND (0.12) *					ND (0.12) *		
ALPHA-BHC									ND (0.12)					ND (0.12)		
BETA-BHC									ND (0.12)					ND (0.12)		
DELTA-BHC									ND (0.12)					ND (0.12)		
GAMMA-BHC (LINDANE)									ND (0.047) *					ND (0.047) *		
CHLORDANE									ND (0.47)					ND (0.47)		
4,4'-DDD									ND (0.094)					ND (0.094)		
4,4'-DDE									ND (0.094)					ND (0.094)		
4,4'-DDT									ND (0.094)					0.11		
DIELDRIN									ND (0.094)					ND (0.094) *		
ENDOSULFAN I									ND (0.12)					ND (0.12)		
ENDOSULFAN II									ND (0.19)					ND (0.19)		
ENDOSULFAN SULFATE									ND (0.19)					ND (0.19)		
ENDRIN									ND (0.19)					ND (0.19)		
ENDRIN KETONE									ND (0.19)					ND (0.19)		
HEPTACHLOR									ND (0.12)					ND (0.12)		
HEPTACHLOR EPOXIDE									ND (0.12) *					ND (0.12) *		
HEXACHLOROBENZENE									ND (0.14)					ND (0.14)		
METHOXYCHLOR									ND (1.2)					ND (1.2)		
SW-846 8151A (mg/kg dry)																
2,4-D									ND (0.029)					ND (0.029)		
2,4-DB									ND (0.029)					ND (0.029)		
2,4,5-TP (SILVEX)									ND (0.0029)					ND (0.0029)		
2,4,5-T									ND (0.0029)					ND (0.0029)		
DALAPON									ND (0.073)					ND (0.073)		
DICAMBA									ND (0.0029)					ND (0.0029)		
DICHLOROPROP									ND (0.029)					ND (0.029)		
DINOSEB									ND (0.015)					ND (0.015)		
MCPA									ND (2.9)					ND (2.9)		
MCPP									ND (2.9)					ND (2.9)		
NOTES:																
1. An asterisk (*) following a detection limit																
indicates that the minimum laboratory reporting																
limit exceeds one or more of the regul. criteria.																
2. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
3. NT = Not tested.																
4. ~ = No Method 1 Standard or UCL available														9. B-7 (03') and B-10 (0-3') were analy		
5. Bolded values exceed the Method 1 Cleanup														Method 8270D. For each PAH, the hi		
Standards (exclusive of S-x/GW-1).														this table.		
6. Italic values exceed MassDEP published																
background conc. for soils assoc. with fill																
containing coal ash or wood ash.																

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	Background	SAMPLING LOCATION														
	Soils assoc. with Fill	B-1 (15'-20')	B-3 (15'-20')	B-3 (15'-20') (25-	B-4 (15'-20')	B-4 (15'-20') (21-	B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-5 (3-6')	B-5 (6-11')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-7 (3-6')	B-7 (6-11')

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION													
	B-8 (0-1')	B-8 (1-3')	B-8 (3-6')	B-8 (6-11')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (3-6')	B-9 (6-9')	B-9 (5'E) (0-1)	B-9 (5'E) (1-3)	B-9 (5'N) (0-1)	B-9 (5'S) (0-1)	B-9 (5'W) (0-1)
Sampling Date	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	9/30/2016	9/30/2016	9/30/2016	9/30/2016	9/30/2016
Sample Depth Relative to Original Grade on March 2016	0-1 Feet	1-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-9 Feet	0-1 Feet	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet
Sample Depth During Investigative Event	0-1 Feet	1-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-9 Feet	0-1 Feet	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet
Sample Depth Relative to October 1, 2016	Excavated and Stockpiled	0-2 Feet	2-5 Feet	5-10 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-9 Feet	0-1 Feet	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet
NOTES:	11													
MADEP-EPH-04-1.1 (mg/Kg dry)														
C9-C18 ALIPHATICS							ND (12)	ND (11)						
C19-C36 ALIPHATICS							ND (12)	ND (11)						
C11-C22 AROMATICS							37	46						
ACENAPHTHENE							ND (0.12)	ND (0.11)						
ACENAPHTHYLENE							ND (0.12)	ND (0.11)						
ANTHRACENE							0.12	0.38						
BENZO(A)ANTHRACENE							0.21	1.2						
BENZO(A)PYRENE							0.22	1.0						
BENZO(B)FLUORANTHENE							0.35	1.3						
BENZO(G,H,I)PERYLENE							0.13	0.54						
BENZO(K)FLUORANTHENE							ND (0.12)	0.50						
CHRYSENE							0.30	1.3						
DIBENZ(A,H)ANTHRACENE							ND (0.12)	ND (0.11)						
FLUORANTHENE							0.44	2.4						
FLUORENE							ND (0.12)	ND (0.11)						
INDENO(1,2,3-CD)PYRENE							0.12	0.59						
2-METHYLNAPHTHALENE							ND (0.12)	ND (0.11)						
NAPHTHALENE							ND (0.12)	ND (0.11)						
PHENANTHRENE							0.51	1.4						
PYRENE							0.49	2.3						
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)														
DIBENZOFURAN (see notes 7, 9)														
DI-N-BUTYLPHTHALATE (see note 7)														
MADEP-VPH-04-1.1 (mg/Kg dry)														
C5-C8 ALIPHATICS														
C9-C12 ALIPHATICS														
C9-C10 AROMATICS														
BENZENE														
ETHYLBENZENE														
METHYL TERT-BUTYL ETHER (MTBE)														
NAPHTHALENE														
TOLUENE														
M/P-XYLENE														
O-XYLENE														

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION													
	B-8 (0-1')	B-8 (1-3')	B-8 (3-6')	B-8 (6-11')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (3-6')	B-9 (6-9')	B-9 (5'E) (0-1)	B-9 (5'E) (1-3)	B-9 (5'N) (0-1)	B-9 (5'S) (0-1)	B-9 (5'W) (0-1)
SW-846 6010C/D (mg/Kg dry) Metals Digestion														
ANTIMONY								ND (2.7)						
ARSENIC								11						
BARIUM								30						
BERYLLIUM								*6.7*						
CADMIUM								0.97						
CHROMIUM (as +3)								14						
LEAD								26						
NICKEL								*42*						
SELENIUM								ND (5.4)						
SILVER								ND (0.54)						
THALLIUM								ND (2.7)						
VANADIUM			*39*	*41*			*390*	***510***	*120*					
ZINC								81						
SW-846 7471B (mg/Kg dry) Metals Digestion														
MERCURY								0.19						
SW-846 7196A (mg/Kg dry)														
CHROMIUM +6														
SW-846 8082A (mg/Kg dry)														
PCB 1016	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1221	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1232	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1242	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1248	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	2.5	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1254	**39**	ND (0.10)	ND (0.11)	ND (0.11)	**42**	**1.1**		ND (0.11)	ND (0.11)	**18**	**9.8**	**7.4**	**30**	**20**
PCB 1260	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	**4.2**	**5.4**	**1.7**	**6.5**	**4.4**
PCB 1262	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
PCB 1268	ND (6.0) *	ND (0.10)	ND (0.11)	ND (0.11)	ND (5.8) *	ND (0.11)		ND (0.11)	ND (0.11)	ND (2.4) *	ND (1.1) *	ND (1.1) *	ND (4.6) *	ND (3.1) *
TOTAL PCBs	**39**	ND (0.10)	ND (0.11)	ND (0.11)	**42**	**1.1**		ND (0.11)	ND (0.11)	**22.2**	**15.2**	**9.1**	**36.5**	**24.4**

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION													
	B-8 (0-1')	B-8 (1-3')	B-8 (3-6')	B-8 (6-11')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (3-6')	B-9 (6-9')	B-9 (5'E) (0-1)	B-9 (5'E) (1-3)	B-9 (5'N) (0-1)	B-9 (5'S) (0-1)	B-9 (5'W) (0-1)
SW-846 8081B (mg/Kg dry)														
ALDRIN								ND (0.11) *						
ALPHA-BHC								ND (0.11)						
BETA-BHC								ND (0.11)						
DELTA-BHC								ND (0.11)						
GAMMA-BHC (LINDANE)								ND (0.046) *						
CHLORDANE								ND (0.46)						
4,4'-DDD								ND (0.091)						
4,4'-DDE								ND (0.091)						
4,4'-DDT								ND (0.091)						
DIELDRIN								ND (0.091) *						
ENDOSULFAN I								ND (0.11)						
ENDOSULFAN II								ND (0.18)						
ENDOSULFAN SULFATE								ND (0.18)						
ENDRIN								ND (0.18)						
ENDRIN KETONE								ND (0.18)						
HEPTACHLOR								ND (0.11)						
HEPTACHLOR EPOXIDE								ND (0.11) *						
HEXACHLOROBENZENE								ND (0.14)						
METHOXYCHLOR								ND (1.1)						
SW-846 8151A (mg/kg dry)														
2,4-D								ND (0.028)						
2,4-DB								ND (0.028)						
2,4,5-TP (SILVEX)								ND (0.0028)						
2,4,5-T								ND (0.0028)						
DALAPON								ND (0.071)						
DICAMBA								ND (0.0028)						
DICHLOROPROP								ND (0.028)						
DINOSEB								ND (0.014)						
MCPA								ND (2.8)						
MCPP								ND (2.8)						
NOTES:														
1. An asterisk (*) following a detection limit														
indicates that the minimum laboratory reporting														
limit exceeds one or more of the regul. criteria.														
2. ND = Not detected above the lab reporting														
limits shown in parenthesis.														
3. NT = Not tested.														
4. ~ = No Method 1 Standard or UCL available	zed for PAHs via both MassDEP's Method and USEPA													
5. Bolded values exceed the Method 1 Cleanup	ghest detected value for both methods is provided in													
Standards (exclusive of S-x/GW-1).														
6. Italic values exceed MassDEP published														
background conc. for soils assoc. with fill														
containing coal ash or wood ash.														

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION													
	B-8 (0-1')	B-8 (1-3')	B-8 (3-6')	B-8 (6-11')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (3-6')	B-9 (6-9')	B-9 (5'E) (0-1)	B-9 (5'E) (1-3)	B-9 (5'N) (0-1)	B-9 (5'S) (0-1)	B-9 (5'W) (0-1)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-10 (0-1')	**B-10 (1-3')**	**B-10 (0-3')**	**B-10 (3-6')**	**B-10 (6-11')**	**B-11 (0-1')**	**B-11 (1-3')**	**B-11 (3-6')**	**B-11 (6-11')**	**B-11-r10B (0-1')**	**B-11-r10B (0-3')**	**B-11-r10B (1-3')**	**B-11-r5A (0-1')**	**B-11-r5A (0-3')**	**B-11-r5A (1-3')**	**B-11-r5B (0-1')**
Sampling Date	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016
Sample Depth Relative to Original Grade on March 2016	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet
Sample Depth During Investigative Event	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	1-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet
Sample Depth Relative to October 1, 2016	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	6-11 Feet	Excavated/ Transported Off-Site	1-3 Feet	3-6 Feet	6-11 Feet	0-1 Feet	0-3 Feet	1-3 Feet	Excavated/ Transported Off-Site	0-2 Feet	0-2 Feet	Excavated/ Transported Off-Site
NOTES:			10			7							7			7
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS			18	ND (11)					ND (12)		180			42		
C19-C36 ALIPHATICS			150	19					46		530			230		
C11-C22 AROMATICS			190	31					51		**1100**			400		
ACENAPHTHENE			0.49	ND (0.11)					ND (0.12)		ND (0.23)			0.46		
ACENAPHTHYLENE			ND (0.46)	ND (0.11)					ND (0.12)		ND (0.23)			0.77		
ANTHRACENE			1.1	ND (0.11)					0.24		0.38			4		
BENZO(A)ANTHRACENE			2.1	0.28					0.54		0.74			**15**		
BENZO(A)PYRENE			1.4	0.29					0.54		0.68			**15**		
BENZO(B)FLUORANTHENE			2.4	0.38					0.68		ND (0.23)			**19**		
BENZO(G,H,I)PERYLENE			1.1	0.18					0.24		0.89			8.7		
BENZO(K)FLUORANTHENE			0.67	0.15					0.25		ND (0.23)			7		
CHRYSENE			2.4	0.37					0.61		1.3			15		
DIBENZ(A,H)ANTHRACENE			ND (0.46)	ND (0.11)					ND (0.12)		ND (0.23)			**2.3**		
FLUORANTHENE			4.1	0.61					1.3		1.7			31		
FLUORENE			0.57	ND (0.11)					ND (0.12)		ND (0.23)			0.6		
INDENO(1,2,3-CD)PYRENE			1.1	0.18					0.32		ND (0.23)			**10**		
2-METHYLNAPHTHALENE			ND (0.46)	ND (0.11)					ND (0.12)		ND (0.23)			0.31		
NAPHTHALENE			ND (0.46)	ND (0.11)					ND (0.12)		ND (0.23)			1.2		
PHENANTHRENE			4.7	0.55					1.1		1.7			**11**		
PYRENE			4.1	0.71					1.4		1.2			31		
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)																
DIBENZOFURAN (see notes 7, 9)																
DI-N-BUTYLPHTHALATE (see note 7)																
MADEP-VPH-04-1.1 (mg/Kg dry)																
C5-C8 ALIPHATICS																
C9-C12 ALIPHATICS																
C9-C10 AROMATICS																
BENZENE																
ETHYLBENZENE																
METHYL TERT-BUTYL ETHER (MTBE)																
NAPHTHALENE																
TOLUENE																
M/P-XYLENE																
O-XYLENE																

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-10 (0-1')	B-10 (1-3')	B-10 (0-3')	B-10 (3-6')	B-10 (6-11')	B-11 (0-1')	B-11 (1-3')	B-11 (3-6')	B-11 (6-11')	B-11-r10B (0-1')	B-11-r10B (0-3')	B-11-r10B (1-3')	B-11-r5A (0-1')	B-11-r5A (0-3')	B-11-r5A (1-3')	B-11-r5B (0-1')
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
ANTIMONY			ND (2.7)					ND (2.8)								
ARSENIC			10					9.2								
BARIUM			*64*					*160*								
BERYLLIUM			*25*					*11*								
CADMIUM			0.82					1.3								
CHROMIUM (as +3)			26					33								
LEAD			68					200								
NICKEL			*64*					*85*								
SELENIUM			ND (5.4)					ND (5.6)								
SILVER			ND (0.54)					ND (0.56)								
THALLIUM			ND (2.7)					ND (2.8)								
VANADIUM			***2100***	***560***	*260*			***900***	***870***		*380*			*140*		
ZINC			65					180								
SW-846 7471B (mg/Kg dry) Metals Digestion																
MERCURY			0.13					1.2								
SW-846 7196A (mg/Kg dry)																
CHROMIUM +6																
SW-846 8082A (mg/Kg dry)																
PCB 1016	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1221	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1232	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1242	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1248	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1254	**21**	0.29		0.79	0.22		0.16	**2**	**6.2**	**6.2**		0.48			**5.4**	
PCB 1260	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	0.75		ND (0.11)			ND (0.59)	
PCB 1262	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
PCB 1268	ND (2.5) *	ND (0.12)		ND (0.11)	ND (0.11)		ND (0.11)	ND (0.23)	ND (1.2) *	ND (0.59)		ND (0.11)			ND (0.59)	
TOTAL PCBs	**21**	0.29		0.79	0.22		0.16	**2.0**	**6.2**	**7.0**		0.48			**5.4**	

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-10 (0-1')	B-10 (1-3')	B-10 (0-3')	B-10 (3-6')	B-10 (6-11')	B-11 (0-1')	B-11 (1-3')	B-11 (3-6')	B-11 (6-11')	B-11-r10B (0-1')	B-11-r10B (0-3')	B-11-r10B (1-3')	B-11-r5A (0-1')	B-11-r5A (0-3')	B-11-r5A (1-3')	B-11-r5B (0-1')
SW-846 8081B (mg/Kg dry)																
ALDRIN			ND (0.12) *					ND (0.12) *								
ALPHA-BHC			ND (0.12)					ND (0.12)								
BETA-BHC			ND (0.12)					ND (0.12)								
DELTA-BHC			ND (0.12)					ND (0.12)								
GAMMA-BHC (LINDANE)			ND (0.046) *					ND (0.047) *								
CHLORDANE			ND (0.46)					ND (0.47)								
4,4'-DDD			ND (0.092)					ND (0.094)								
4,4'-DDE			ND (0.092)					ND (0.094)								
4,4'-DDT			ND (0.092)					0.16								
DIELDRIN			ND (0.092) *					ND (0.094) *								
ENDOSULFAN I			ND (0.12)					ND (0.12)								
ENDOSULFAN II			ND (0.18)					ND (0.19)								
ENDOSULFAN SULFATE			ND (0.18)					ND (0.19)								
ENDRIN			ND (0.18)					ND (0.19)								
ENDRIN KETONE			ND (0.18)					ND (0.19)								
HEPTACHLOR			ND (0.12)					ND (0.12)								
HEPTACHLOR EPOXIDE			ND (0.12) *					ND (0.12) *								
HEXACHLOROBENZENE			ND (0.14)					ND (0.14)								
METHOXYCHLOR			ND (1.2)					ND (1.2)								
SW-846 8151A (mg/kg dry)																
2,4-D			ND (0.029)					ND (0.029)								
2,4-DB			ND (0.029)					ND (0.029)								
2,4,5-TP (SILVEX)			ND (0.0029)					ND (0.0029)								
2,4,5-T			ND (0.0029)					ND (0.0029)								
DALAPON			ND (0.072)					ND (0.073)								
DICAMBA			ND (0.0029)					ND (0.0029)								
DICHLOROPROP			ND (0.029)					ND (0.029)								
DINOSEB			ND (0.014)					ND (0.015)								
MCPA			ND (2.9)					ND (2.9)								
MCPP			ND (2.9)					ND (2.9)								
NOTES:																
1. An asterisk (*) following a detection limit																
indicates that the minimum laboratory reporting																
limit exceeds one or more of the regul. criteria.																
2. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
3. NT = Not tested.																
4. ~ = No Method 1 Standard or UCL available																
5. Bolded values exceed the Method 1 Cleanup																
Standards (exclusive of S-x/GW-1).																
6. Italic values exceed MassDEP published																
background conc. for soils assoc. with fill																
containing coal ash or wood ash.																

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-10 (0-1')	B-10 (1-3')	B-10 (0-3')	B-10 (3-6')	B-10 (6-11')	B-11 (0-1')	B-11 (1-3')	B-11 (3-6')	B-11 (6-11')	B-11-r10B (0-1')	B-11-r10B (0-3')	B-11-r10B (1-3')	B-11-r5A (0-1')	B-11-r5A (0-3')	B-11-r5A (1-3')	B-11-r5B (0-1')

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	**B-11-r5B (1-3')**	**B-11-r5C (0-1')**	**B-11-r5C (0-3')**	**B-11-r5C (1-3')**	**Btm-B11-ex**	**ESW-B11-ex**	**WSW-B11-ex**	**B-12 (0-1')**	**B-12 (1-3')**	**B-12 (0-3')**	**B-12 (3-6')**	**B-13 (0-1')**	**B-13 (1-3')**	**B-13 (0-3')**	**B-13 (3-6')**
Sampling Date	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	5/27/2016	5/27/2016	5/27/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016
Sample Depth Relative to Original Grade on March 2016	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	1-1.5 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet
Sample Depth During Investigative Event	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	1-1.5 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet	0-1 Feet	1-3 Feet	0-3 Feet	3-6 Feet
Sample Depth Relative to October 1, 2016	0-2 Feet	0-2 Feet	Excavated/ Transported Off-Site	0-2 Feet	0-2 Feet	0-0.5 Feet	0-1 Feet	0-1 Feet	Excavated and Put in Dry Well	0-2 Feet	0-2 Feet	2-5 Feet	Excavated and Put in Dry Well	0-2 Feet	0-2 Feet	2-5 Feet
NOTES:			7			12	12	12	16	15	15	15	16	15	15	15
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS	24			57							ND (31)	ND (11)			17	ND (12)
C19-C36 ALIPHATICS	120			310							65	16			80	19
C11-C22 AROMATICS	97			290							130	34			240	26
ACENAPHTHENE	0.58			0.49							1.3	0.39			1.1	0.93
ACENAPHTHYLENE	ND (0.23)			ND (0.24)							ND (0.15)	ND (0.11)			ND (0.14)	ND (0.24)
ANTHRACENE	0.86			0.88							2.3	0.52			0.42	1.5
BENZO(A)ANTHRACENE	1.4			1.5							2.8	0.70			0.60	2.3
BENZO(A)PYRENE	1.2			1.6							**2.2**	0.67			1.0	1.9
BENZO(B)FLUORANTHENE	1.5			2							3.4	0.85			0.84	2.5
BENZO(G,H,I)PERYLENE	0.58			0.98							0.93	0.36			0.32	0.96
BENZO(K)FLUORANTHENE	0.53			0.78							1.4	0.33			0.28	0.92
CHRYSENE	1.6			1.8							2.8	0.68			2.6	0.25
DIBENZ(A,H)ANTHRACENE	ND (0.23)			ND (0.24)							0.41	ND (0.11)			0.35	ND (0.24)
FLUORANTHENE	3.3			5.1							7.8	1.9			1.8	0.56
FLUORENE	0.41			0.42							1.3	0.22			0.17	0.74
INDENO(1,2,3-CD)PYRENE	0.7			1							1.2	0.41			1.5	1.2
2-METHYLNAPHTHALENE	ND (0.23)			0.28							0.45	ND (0.11)			ND (0.14)	ND (0.24)
NAPHTHALENE	ND (0.23)			0.88							0.98	0.16			0.68	ND (0.24)
PHENANTHRENE	4			3.2							8.8	1.8			6.9	5.9
PYRENE	3.5			3.7							7.1	1.7			6.4	0.51
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)																
DIBENZOFURAN (see notes 7, 9)																
DI-N-BUTYLPHTHALATE (see note 7)																
MADEP-VPH-04-1.1 (mg/Kg dry)																
C5-C8 ALIPHATICS																
C9-C12 ALIPHATICS																
C9-C10 AROMATICS																
BENZENE																
ETHYLBENZENE																
METHYL TERT-BUTYL ETHER (MTBE)																
NAPHTHALENE																
TOLUENE																
M/P-XYLENE																
O-XYLENE																

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	B-11-r5B (1-3')	B-11-r5C (0-1')	B-11-r5C (0-3')	B-11-r5C (1-3')	Btm-B11-ex	ESW-B11-ex	WSW-B11-ex	B-12 (0-1')	B-12 (1-3')	B-12 (0-3')	B-12 (3-6')	B-13 (0-1')	B-13 (1-3')	B-13 (0-3')	B-13 (3-6')
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
ANTIMONY																
ARSENIC											4.4	4.1			8.3	5.1
BARIUM																
BERYLLIUM																
CADMIUM																
CHROMIUM (as +3)																
LEAD											**210**	120			***1300***	34
NICKEL																
SELENIUM																
SILVER																
THALLIUM																
VANADIUM	***550***			***640***							20	13			*35*	22
ZINC																
SW-846 7471B (mg/Kg dry) Metals Digestion																
MERCURY																
SW-846 7196A (mg/Kg dry)																
CHROMIUM +6																
SW-846 8082A (mg/Kg dry)																
PCB 1016		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1221		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1232		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1242		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1248		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1254		0.19			**2.9**	0.79	0.38	**1.1**	**11**	0.26		0.37	**12**	**25**		ND (0.12)
PCB 1260		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1262		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
PCB 1268		ND (0.11)			ND (0.57)	ND (0.11)	ND (0.12)	ND (0.11)	ND (2.5) *	ND (0.10)		ND (0.11)	ND (3.2) *	ND (6.3) *		ND (0.12)
TOTAL PCBs		0.19			**2.9**	0.79	0.38	**1.1**	**11**	0.26		0.37	**12**	**25**		ND (0.12)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	B-11-r5B (1-3')	B-11-r5C (0-1')	B-11-r5C (0-3')	B-11-r5C (1-3')	Btm-B11-ex	ESW-B11-ex	WSW-B11-ex	B-12 (0-1')	B-12 (1-3')	B-12 (0-3')	B-12 (3-6')	B-13 (0-1')	B-13 (1-3')	B-13 (0-3')	B-13 (3-6')
SW-846 8081B (mg/Kg dry)																
ALDRIN																
ALPHA-BHC																
BETA-BHC																
DELTA-BHC																
GAMMA-BHC (LINDANE)																
CHLORDANE																
4,4'-DDD																
4,4'-DDE																
4,4'-DDT																
DIELDRIN																
ENDOSULFAN I																
ENDOSULFAN II																
ENDOSULFAN SULFATE																
ENDRIN																
ENDRIN KETONE																
HEPTACHLOR																
HEPTACHLOR EPOXIDE																
HEXACHLOROBENZENE																
METHOXYCHLOR																
SW-846 8151A (mg/kg dry)																
2,4-D																
2,4-DB																
2,4,5-TP (SILVEX)																
2,4,5-T																
DALAPON																
DICAMBA																
DICHLOROPROP																
DINOSEB																
MCPA																
MCPP																
NOTES:																
1. An asterisk (*) following a detection limit																
indicates that the minimum laboratory reporting																
limit exceeds one or more of the regul. criteria.																
2. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
3. NT = Not tested.																
4. ~ = No Method 1 Standard or UCL available																
5. Bolded values exceed the Method 1 Cleanup																
Standards (exclusive of S-x/GW-1).																
6. Italic values exceed MassDEP published																
background conc. for soils assoc. with fill																
containing coal ash or wood ash.																

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	B-11-r5B (1-3')	B-11-r5C (0-1')	B-11-r5C (0-3')	B-11-r5C (1-3')	Btm-B11-ex	ESW-B11-ex	WSW-B11-ex	B-12 (0-1')	B-12 (1-3')	B-12 (0-3')	B-12 (3-6')	B-13 (0-1')	B-13 (1-3')	B-13 (0-3')	B-13 (3-6')

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATIONS														
	BTM-GT-1	**BTM-GT-2**	**ESW-GT-1**	**NSW-GT-1**	**NSW-GT-2**	**SSW-GT-1**	**SSW-GT-2**	**WSW-GT-2**	**SP-1**	**FO-1 (3')**	**SP-3**	**FO-1-TP (0-1')**	**FO-1-TP (1-2')**	**FO-1-TP (2-3')**	**FO-1-BTM**
Sampling Date	3/8/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016	2/29/2016	3/9/2016	3/29/2016	3/9/2016	3/9/2016	3/9/2016	3/10/2016
Sample Depth Relative to Original Grade on March 2016	6 Feet	8 Feet	3-4 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	5-6 Feet	Stockpile / Top Soils	3.5 Feet	Stockpile	0-1 Feet	1-2 Feet	2-3 Feet	5.5 Feet
Sample Depth During Investigative Event	6 Feet	8 Feet	3-4 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	5-6 Feet	Stockpile / Top Soils	3.5 Feet (just in vault)	Stockpile / Sands in vault	0-1 Feet (below grade / above vault)	1-2 Feet (below grade / above vault)	2-3 Feet (below grade / above vault)	Bottom of vault (5.5 feet below grade)
Sample Depth Relative to October 1, 2016	3 Feet	5 Feet	0-1 Feet	0-1 Feet	2-3 Feet	0-1 Feet	2-3 Feet	2-3 Feet	Removed from Site	0.5 Feet (just in vault)	Stockpile / Sands in vault	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	Bottom of vault (2.5 feet below grade)
NOTES:									7	8	9				8
MADEP-EPH-04-1.1 (mg/Kg dry)															
C9-C18 ALIPHATICS	ND (12)	ND (11)	13	34	ND (22)	ND (11)	37	ND (11)		ND (10)					
C19-C36 ALIPHATICS	ND (12)	31	29	140	77	17	200	ND (11)		ND (10)					
C11-C22 AROMATICS	25	45	41	420	120	31	210	33		ND (10)					
ACENAPHTHENE	ND (0.12)	ND (0.11)	ND (0.11)	1.7	0.37	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	0.70				
ACENAPHTHYLENE	ND (0.12)	ND (0.11)	ND (0.11)	ND (0.23)	ND (0.22)	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	ND (0.18)				
ANTHRACENE	ND (0.12)	ND (0.11)	ND (0.11)	*4.7*	0.73	ND (0.11)	ND (0.43)	0.18		ND (0.10)	1.5				
BENZO(A)ANTHRACENE	ND (0.12)	ND (0.11)	ND (0.11)	***10***	1.7	ND (0.11)	0.78	0.5		ND (0.10)	3.0				
BENZO(A)PYRENE	0.27	0.11	ND (0.11)	***9.3***	0.69	0.24	0.94	0.52		ND (0.10)	**2.6**				
BENZO(B)FLUORANTHENE	0.32	0.15	ND (0.11)	***13***	2	0.31	1.1	0.67		ND (0.10)	3.5				
BENZO(G,H,I)PERYLENE	0.38	ND (0.11)	ND (0.11)	*4.9*	0.96	0.33	0.77	0.41		ND (0.10)	1.4				
BENZO(K)FLUORANTHENE	ND (0.12)	ND (0.11)	ND (0.11)	*4.8*	0.73	ND (0.11)	0.44	0.26		ND (0.10)	1.4				
CHRYSENE	0.15	0.11	ND (0.11)	*12*	1.8	0.17	1.0	0.59		ND (0.10)	2.8				
DIBENZ(A,H)ANTHRACENE	ND (0.12)	ND (0.11)	ND (0.11)	***1.5***	ND (0.22)	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	0.59				
FLUORANTHENE	0.15	0.17	0.14	*27*	3.7	0.19	1.6	1.1		ND (0.10)	7.0				
FLUORENE	ND (0.12)	ND (0.11)	ND (0.11)	*2.1*	0.37	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	0.93				
INDENO(1,2,3-CD)PYRENE	0.36	ND (0.11)	ND (0.11)	*5.2*	0.93	0.25	0.56	0.36		ND (0.10)	1.4				
2-METHYLNAPHTHALENE	ND (0.12)	ND (0.11)	ND (0.11)	0.48	ND (0.22)	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	0.29				
NAPHTHALENE	ND (0.12)	ND (0.11)	ND (0.11)	0.70	ND (0.22)	ND (0.11)	ND (0.43)	ND (0.11)		ND (0.10)	0.59				
PHENANTHRENE	0.34	ND (0.11)	0.4	19	3	0.24	1.2	0.74		ND (0.10)	5.9				
PYRENE	ND (0.12)	0.18	0.13	*25*	3.4	0.19	1.6	1		ND (0.10)	5.0				
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)											ND (0.36)				
DIBENZOFURAN (see notes 7, 9)											0.37				
DI-N-BUTYLPHTHALATE (see note 7)											ND (0.36)				
MADEP-VPH-04-1.1 (mg/Kg dry)															
C5-C8 ALIPHATICS	ND (9.6)	ND (9.9)	ND (9.5)	ND (8.6)	ND (8.3)	ND (10)	ND (11)	ND (8.2)		ND (7.9)	ND (8.9)				ND (8.3)
C9-C12 ALIPHATICS	ND (9.6)	ND (9.9)	ND (9.5)	ND (8.6)	ND (8.3)	ND (10)	ND (11)	ND (8.2)		ND (7.9)	ND (8.9)				ND (8.3)
C9-C10 AROMATICS	ND (9.6)	ND (9.9)	ND (9.5)	ND (8.6)	ND (8.3)	ND (10)	ND (11)	ND (8.2)		ND (7.9)	ND (8.9)				ND (8.3)
BENZENE	0.10	0.058	0.15	ND (0.043)	ND (0.042)	ND (0.052)	ND (0.053)	ND (0.041)		ND (0.040)	ND (0.044)				ND (0.042)
ETHYLBENZENE	ND (0.048)	ND (0.050)	ND (0.047)	ND (0.043)	ND (0.042)	ND (0.052)	ND (0.053)	ND (0.041)		ND (0.040)	ND (0.044)				ND (0.042)
METHYL TERT-BUTYL ETHER (MTBE)	ND (0.048)	ND (0.050)	ND (0.047)	ND (0.043)	ND (0.042)	ND (0.052)	ND (0.053)	ND (0.041)		ND (0.040)	ND (0.044)				ND (0.042)
NAPHTHALENE	ND (0.24)	ND (0.25)	ND (0.24)	ND (0.22)	ND (0.21)	ND (0.26)	ND (0.26)	ND (0.20)		ND (0.20)	ND (0.22)				ND (0.21)
TOLUENE	0.60	0.32	0.23	0.14	ND (0.042)	0.25	0.087	ND (0.041)		ND (0.040)	ND (0.044)				ND (0.042)
M/P-XYLENE	ND (0.096)	ND (0.099)	ND (0.095)	ND (0.086)	ND (0.083)	ND (0.10)	ND (0.11)	ND (0.082)		ND (0.079)	ND (0.089)				ND (0.083)
O-XYLENE	ND (0.048)	ND (0.050)	ND (0.047)	ND (0.043)	ND (0.042)	ND (0.052)	ND (0.053)	ND (0.041)		ND (0.040)	ND (0.044)				ND (0.042)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATIONS														
	BTM-GT-1	BTM-GT-2	ESW-GT-1	NSW-GT-1	NSW-GT-2	SSW-GT-1	SSW-GT-2	WSW-GT-2	SP-1	FO-1 (3')	SP-3	FO-1-TP (0-1')	FO-1-TP (1-2')	FO-1-TP (2-3')	FO-1-BTM
SW-846 6010C/D (mg/Kg dry) Metals Digestion															
ANTIMONY	ND (2.9)	ND (2.7)	ND (2.8)	ND (2.6)	ND (2.8)	ND (2.8)	ND (2.8)	ND (2.7)		ND (2.6)	ND (2.4)	3	ND (2.9)	ND (2.9)	ND (2.5)
ARSENIC	7.4	ND (2.7)	14	9.8	6	3.1	5.7	4.4		15	8.8	19	14	18	7
BARIUM	34	27	43	*72*	42	27	31	28		32	50	*140*	*95*	*130*	30
BERYLLIUM	ND (0.29)	ND (0.27)	ND (0.28)	ND (0.26)	ND (0.28)	ND (0.28)	ND (0.28)	ND (0.27)		0.63	0.73	0.68	0.39	*1.9*	ND (0.25)
CADMIUM	0.36	0.34	1.0	0.81	0.61	ND (0.28)	0.60	0.33		0.51	0.44	1.4	0.98	1.3	0.26
CHROMIUM (as +3)	11	10	14	26	19	12	18	11		25	30	36	31	37	20
LEAD	100	41	**290**	**230**	64	58	59	40		7	25	**340**	***1100***	**220**	6.3
NICKEL	11	8.9	23	22	14	9.0	18	8.8		20	18	*32*	22	29	14
SELENIUM	ND (5.9)	ND (5.4)	ND (5.6)	ND (5.3)	ND (5.6)	ND (5.6)	ND (5.5)	ND (5.5)		ND (5.2)	ND (4.8)	ND (5.7)	ND (5.9)	ND (5.7)	ND (5.0)
SILVER	ND (0.59)	ND (0.54)	ND (0.56)	ND (0.53)	ND (0.56)	ND (0.56)	ND (0.55)	ND (0.55)		ND (0.52)	ND (0.48)	ND (1.1)	ND (0.59)	ND (0.57)	ND (0.50)
THALLIUM	ND (2.9)	ND (2.7)	ND (2.8)	ND (2.6)	ND (2.8)	ND (2.8)	ND (2.8)	ND (2.7)		ND (2.6)	**9.8**	ND (2.8)	ND (2.9)	ND (2.9)	ND (2.5)
VANADIUM	27	14	*36*	*100*	*32*	14	*50*	15		*32*	33	*160*	*96*	*140*	29
ZINC	37	43	210	140	89	42	79	35		23	43	250	160	190	29
SW-846 7471B (mg/Kg dry) Metals Digestion															
MERCURY	0.14	0.095	0.63	*1.3*	0.25	0.10	0.51	0.099		ND (0.025)	0.050	0.68	0.93	0.84	ND (0.026)
SW-846 7196A (mg/Kg dry)															
CHROMIUM +6															
SW-846 8082A (mg/Kg dry)															
PCB 1016	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1221	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1232	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1242	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1248	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1254	ND (0.11)	ND (0.11)	ND (0.11)	**6.3**	**1.2**	ND (0.11)	0.35	0.16		ND (0.10)	**2.6**	**13**	**12**	**7.8**	ND (0.11)
PCB 1260	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1262	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
PCB 1268	ND (0.11)	ND (0.11)	ND (0.11)	ND (1.1) *	ND (0.11)	ND (0.11)	ND (0.11)	ND (0.11)		ND (0.10)	ND (0.53)	ND (2.3) *	ND (2.3) *	ND (1.1) *	ND (0.11)
TOTAL PCBs	ND (0.11)	ND (0.11)	ND (0.11)	**6.3**	**1.2**	ND (0.11)	0.35	0.16		ND (0.10)	**2.6**	**13**	**12**	**7.8**	ND (0.11)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATIONS														
	BTM-GT-1	BTM-GT-2	ESW-GT-1	NSW-GT-1	NSW-GT-2	SSW-GT-1	SSW-GT-2	WSW-GT-2	SP-1	FO-1 (3')	SP-3	FO-1-TP (0-1')	FO-1-TP (1-2')	FO-1-TP (2-3')	FO-1-BTM
SW-846 8081B (mg/Kg dry)															
ALDRIN	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11) *	ND (0.11) *	ND (0.0056)	ND (0.11) *	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11) *	ND (0.12) *	ND (0.11) *	ND (0.0054)
ALPHA-BHC	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11)	ND (0.11)	ND (0.0056)	ND (0.11)	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11)	ND (0.12)	ND (0.11)	ND (0.0054)
BETA-BHC	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11)	ND (0.11)	ND (0.0056)	ND (0.11)	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11)	ND (0.12)	ND (0.11)	ND (0.0054)
DELTA-BHC	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11)	ND (0.11)	ND (0.0056)	ND (0.11)	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11)	ND (0.12)	ND (0.11)	ND (0.0054)
GAMMA-BHC (LINDANE)	ND (0.0023)	ND (0.022) *	ND (0.0022)	ND (0.045) *	ND (0.044) *	ND (0.0022)	ND (0.043) *	ND (0.0022)		ND (0.0021)	ND (0.0021)	ND (0.046) *	ND (0.046) *	ND (0.045) *	ND (0.0022)
CHLORDANE	ND (0.023)	ND (0.22)	ND (0.022)	ND (0.45)	ND (0.44)	ND (0.022)	ND (0.43)	0.045		ND (0.021)	ND (0.021)	ND (0.46)	ND (0.46)	ND (0.45)	ND (0.022)
4,4'-DDD	ND (0.0046)	ND (0.044)	ND (0.0045)	ND (0.090)	ND (0.088)	ND (0.0045)	ND (0.087)	ND (0.0044)		ND (0.0041)	ND (0.0042)	ND (0.092)	ND (0.093)	ND (0.090)	ND (0.0043)
4,4'-DDE	ND (0.0046)	ND (0.044)	ND (0.0045)	ND (0.090)	ND (0.088)	ND (0.0045)	ND (0.087)	ND (0.0044)		ND (0.0041)	ND (0.0042)	ND (0.092)	0.093	ND (0.090)	ND (0.0043)
4,4'-DDT	ND (0.0046)	ND (0.044)	ND (0.0045)	ND (0.090)	ND (0.088)	ND (0.0045)	ND (0.087)	ND (0.0044)		ND (0.0041)	0.019	0.15	0.13	0.13	ND (0.0043)
DIELDRIN	ND (0.0046)	ND (0.044)	ND (0.0045)	**0.11**	ND (0.088) *	ND (0.0045)	ND (0.087) *	ND (0.0044)		ND (0.0041)	ND (0.0042)	**0.16**	**0.19**	**0.16**	ND (0.0043)
ENDOSULFAN I	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11)	ND (0.11)	ND (0.0056)	ND (0.11)	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11)	ND (0.12)	ND (0.11)	ND (0.0054)
ENDOSULFAN II	ND (0.0092)	ND (0.088)	ND (0.0089)	ND (0.18)	ND (0.18)	ND (0.0089)	ND (0.17)	ND (0.0088)		ND (0.0082)	ND (0.0085)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.0086)
ENDOSULFAN SULFATE	ND (0.0092)	ND (0.088)	ND (0.0089)	ND (0.18)	ND (0.18)	ND (0.0089)	ND (0.17)	ND (0.0088)		ND (0.0082)	ND (0.0085)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.0086)
ENDRIN	ND (0.0092)	ND (0.088)	ND (0.0089)	ND (0.18)	ND (0.18)	ND (0.0089)	ND (0.17)	ND (0.0088)		ND (0.0082)	ND (0.0085)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.0086)
ENDRIN KETONE	ND (0.0092)	ND (0.088)	ND (0.0089)	ND (0.18)	ND (0.18)	ND (0.0089)	ND (0.17)	ND (0.0088)		ND (0.0082)	ND (0.0085)	ND (0.18)	ND (0.19)	ND (0.18)	ND (0.0086)
HEPTACHLOR	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11)	ND (0.11)	ND (0.0056)	ND (0.11)	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11)	ND (0.12)	ND (0.11)	ND (0.0054)
HEPTACHLOR EPOXIDE	ND (0.0058)	ND (0.055)	ND (0.0056)	ND (0.11) *	ND (0.11) *	ND (0.0056)	ND (0.11) *	ND (0.0055)		ND (0.0051)	ND (0.0053)	ND (0.11) *	ND (0.12) *	ND (0.11) *	ND (0.0054)
HEXACHLOROBENZENE	ND (0.0069)	ND (0.066)	ND (0.0067)	ND (0.14)	ND (0.13)	ND (0.0067)	ND (0.13)	ND (0.0066)		ND (0.0062)	ND (0.0064)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.0065)
METHOXYCHLOR	ND (0.058)	ND (0.55)	ND (0.056)	ND (1.1)	ND (1.1)	ND (0.056)	ND (1.1)	ND (0.055)		ND (0.051)	ND (0.053)	ND (1.1)	ND (1.2)	ND (1.1)	ND (0.054)
SW-846 8151A (mg/kg dry)															
2,4-D											ND (0.026)				ND (0.027)
2,4-DB											ND (0.026)				ND (0.027)
2,4,5-TP (SILVEX)											ND (0.026)				ND (0.0027)
2,4,5-T											ND (0.026)				ND (0.0027)
DALAPON											ND (0.066)				ND (0.068)
DICAMBA											ND (0.0026)				ND (0.0027)
DICHLOROPROP											ND (0.026)				ND (0.027)
DINOSEB											ND (0.013)				ND (0.014)
MCPA											ND (2.6)				ND (2.7)
MCPP											ND (2.6)				ND (2.7)

NOTES:

1. An asterisk (*) following a detection limit indicates that the minimum laboratory reporting limit exceeds one or more of the regul. criteria.
2. ND = Not detected above the lab reporting limits shown in parenthesis.
3. NT = Not tested.
4. ~ = No Method 1 Standard or UCL available
5. Bolded values exceed the Method 1 Cleanup Standards (exclusive of S-x/GW-1).
6. Italic values exceed MassDEP published background conc. for soils assoc. with fill containing coal ash or wood ash.
7. SP-1 is a sample from stockpile of surficial soil samples. It was analyzed for VOCs via USEPA Method 8260C. None were detected. It was also analyzed for SVOCs via USEPA Method 8270. PAHs, 2 phthalates and dibenzofuran were detected. These data are summarized with the EPH/PAH data. Analysis for TPH via USEPA Method 8100M was also conducted. TPH was detected at 3800 mg/kg.
8. FO-1 (3') and FO-1-BTM are samples inside and beneath vault. They were analyzed for VOCs via USEPA Method 8260C and SVOCs via USEPA Method 8270. No VOCs or SVOCs were detected. Analysis for TPH via USEPA Method 8100M was also conducted. No TPH was detected in FO-1 (3') and 31 mg/kg TPH was detected in FO-1-BTM.
9. SP-3 was analyzed for VPH via MADEP's Method and for VOCs via USEPA Method 8260C. No VPH or VOCs were detected. It was also analyzed for SVOCs via USEPA Method 8270. Only PAHs and dibenzofuran were detected and they are reported with the EPH data.

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATIONS														
	BTM-GT-1	BTM-GT-2	ESW-GT-1	NSW-GT-1	NSW-GT-2	SSW-GT-1	SSW-GT-2	WSW-GT-2	SP-1	FO-1 (3')	SP-3	FO-1-TP (0-1')	FO-1-TP (1-2')	FO-1-TP (2-3')	FO-1-BTM

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-14 (10-15)	**B-14A (0-5)**	**B-14A (5-10)**	**B-14A (10-15)**	**B-14A (10-15)**	**B-14A (15-16.5)**	**B-15 (0-5)**	**B-15 (5-10)**	**B-16 (0-5)**	**B-16 (5-10)**	**B-16 (10-15)**	**B-17 (5-7.5)**	**B-18 (0-5)**	**B-18 (5-10)**	**B-18 (10-15)**
Sampling Date	9/15/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016
Sample Depth Relative to Original Grade on March 2016	13-18 Feet	3-8 Feet	8-13 Feet	13-18 Feet	13-18 Feet	18-19.5 Feet	3-8 Feet	8-13 Feet	3-8 Feet	8-13 Feet	13-18 Feet	8-10.5 Feet	3-8 Feet	8-10 Feet	13-18 Feet
Sample Depth During Investigative Event	10-15 Feet	0-5 Feet	5-10 Feet	10-15 Feet	10-15 Feet	15-16.5 Feet	0-5 Feet	5-10 Feet	0-5 Feet	5-10 Feet	10-15 Feet	5-7.5 Feet	0-5 Feet	5-10 Feet	10-15 Feet
Sample Depth Relative to October 1, 2016	10-15 Feet	0-5 Feet	5-10 Feet	10-15 Feet	10-15 Feet	15-16.5 Feet	0-5 Feet	5-10 Feet	0-5 Feet	5-10 Feet	10-15 Feet	5-7.5 Feet	0-5 Feet	5-10 Feet	10-15 Feet
NOTES:															
MADEP-EPH-04-1.1 (mg/Kg dry)															
C9-C18 ALIPHATICS		**2400**	**1300**	**8300**		220		140			150	85		28	59
C19-C36 ALIPHATICS		**3400**	2100	**11000**		420		**4700**			380	670		33	310
C11-C22 AROMATICS		**7200**	**2500**	**15000**		**1600**		**3700**			850	650		90	530
ACENAPHTHENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
ACENAPHTHYLENE		ND (2.9) *	ND (0.56)	ND (2.4) *		ND (1.3) *		ND (1.1) *			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
ANTHRACENE		ND (2.9)	1.4	*11*		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
BENZO(A)ANTHRACENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
BENZO(A)PYRENE		ND (2.9) *	ND (0.56)	ND (2.4) *		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
BENZO(B)FLUORANTHENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		0.15	ND (0.52)
BENZO(G,H,I)PERYLENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
BENZO(K)FLUORANTHENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
CHRYSENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		0.25	ND (0.52)
DIBENZ(A,H)ANTHRACENE		ND (2.9) *	ND (0.56)	ND (2.4) *		ND (1.3) *		ND (1.1) *			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
FLUORANTHENE		*12*	4.6	*22*		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		0.15	ND (0.52)
FLUORENE		ND (2.9)	*3.1*	*29*		*4.9*		ND (1.1)			ND (0.20)	ND (0.21)		0.13	ND (0.52)
INDENO(1,2,3-CD)PYRENE		ND (2.9)	ND (0.56)	ND (2.4)		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		ND (0.12)	ND (0.52)
2-METHYLNAPHTHALENE		***12***	***5.7***	***65***		***1.9***		ND (1.1) *			ND (0.20)	ND (0.21)		0.16	ND (0.52)
NAPHTHALENE		ND (2.9)	*3.1*	***27***		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		0.31	ND (0.52)
PHENANTHRENE		**12**	4.0	***35***		4.6		ND (1.1)			ND (0.20)	0.63		0.49	ND (0.52)
PYRENE		7.1	1.7	12		ND (1.3)		ND (1.1)			ND (0.20)	ND (0.21)		0.18	ND (0.52)
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)															
DIBENZOFURAN (see notes 7, 9)															
DI-N-BUTYLPHTHALATE (see note 7)															
MADEP-VPH-04-1.1 (mg/Kg dry)															
C5-C8 ALIPHATICS															
C9-C12 ALIPHATICS															
C9-C10 AROMATICS															
BENZENE															
ETHYLBENZENE															
METHYL TERT-BUTYL ETHER (MTBE)															
NAPHTHALENE															
TOLUENE															
M/P-XYLENE															
O-XYLENE															

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-14 (10-15)	B-14A (0-5)	B-14A (5-10)	B-14A (10-15)	B-14A (10-15)	B-14A (15-16.5)	B-15 (0-5)	B-15 (5-10)	B-16 (0-5)	B-16 (5-10)	B-16 (10-15)	B-17 (5-7.5)	B-18 (0-5)	B-18 (5-10)	B-18 (10-15)
SW-846 6010C/D (mg/Kg dry) Metals Digestion															
ANTIMONY															
ARSENIC															
BARIUM															
BERYLLIUM															
CADMIUM															
CHROMIUM (as +3)															
LEAD															
NICKEL															
SELENIUM															
SILVER															
THALLIUM															
VANADIUM															
ZINC															
SW-846 7471B (mg/Kg dry) Metals Digestion															
MERCURY															
SW-846 7196A (mg/Kg dry)															
CHROMIUM +6															
SW-846 8082A (mg/Kg dry)															
PCB 1016		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1221		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1232		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1242		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1248		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1254		ND (0.15)	0.14	0.14		ND (0.13)	**12**	0.30	0.90				**29**	ND (0.12)	ND (0.10)
PCB 1260		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1262		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
PCB 1268		ND (0.15)	ND (0.11)	ND (0.12)		ND (0.13)	ND (2.2) *	ND (0.11)	ND (0.11)				ND (5.5) *	ND (0.12)	ND (0.10)
TOTAL PCBs		ND (0.15)	0.14	0.14		ND (0.13)	**12**	0.30	0.90				**29**	ND (0.12)	ND (0.10)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-14 (10-15)	B-14A (0-5)	B-14A (5-10)	B-14A (10-15)	B-14A (10-15)	B-14A (15-16.5)	B-15 (0-5)	B-15 (5-10)	B-16 (0-5)	B-16 (5-10)	B-16 (10-15)	B-17 (5-7.5)	B-18 (0-5)	B-18 (5-10)	B-18 (10-15)
SW-846 8081B (mg/Kg dry)															
ALDRIN															
ALPHA-BHC															
BETA-BHC															
DELTA-BHC															
GAMMA-BHC (LINDANE)															
CHLORDANE															
4,4'-DDD															
4,4'-DDE															
4,4'-DDT															
DIELDRIN															
ENDOSULFAN I															
ENDOSULFAN II															
ENDOSULFAN SULFATE															
ENDRIN															
ENDRIN KETONE															
HEPTACHLOR															
HEPTACHLOR EPOXIDE															
HEXACHLOROBENZENE															
METHOXYCHLOR															
SW-846 8151A (mg/kg dry)															
2,4-D															
2,4-DB															
2,4,5-TP (SILVEX)															
2,4,5-T															
DALAPON															
DICAMBA															
DICHLOROPROP															
DINOSEB															
MCPA															
MCPP															
NOTES:															
1. An asterisk (*) following a detection limit															
indicates that the minimum laboratory reporting															
limit exceeds one or more of the regul. criteria.															
2. ND = Not detected above the lab reporting															
limits shown in parenthesis.															
3. NT = Not tested.															
4. ~ = No Method 1 Standard or UCL available															
5. Bolded values exceed the Method 1 Cleanup															
Standards (exclusive of S-x/GW-1).															
6. Italic values exceed MassDEP published															
background conc. for soils assoc. with fill															
containing coal ash or wood ash.															

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-14 (10-15)	B-14A (0-5)	B-14A (5-10)	B-14A (10-15)	B-14A (10-15)	B-14A (15-16.5)	B-15 (0-5)	B-15 (5-10)	B-16 (0-5)	B-16 (5-10)	B-16 (10-15)	B-17 (5-7.5)	B-18 (0-5)	B-18 (5-10)	B-18 (10-15)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-19 (0-5)	**B-19 (5-10)**	**B-19 (10-15)**	**B-19 (15-17)**	**B-20 (0-5)**	**B-20 (5-8)**	**B-21 (0-5)**	**B-21 (5-10)**	**B-21 (10-13.5)**	**B-22 (10-15)**	**B-22 (15-20)**	**B-23 (5-9)**	**B-26 (10-13)**	**B-27 (5-10)**	**B-28 (10-15)**
Sampling Date	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016
Sample Depth Relative to Original Grade on March 2016	3-8 Feet	8-13 Feet	13-18 Feet	18-20 Feet	3-8 Feet	8-11 Feet	3-8 Feet	8-13 Feet	13-16.5 Feet	11-16 Feet	16-21 Feet	6-10 Feet	13-16 Feet	8-13 Feet	13-18 Feet
Sample Depth During Investigative Event	0-5 Feet	5-10 Feet	10-15 Feet	15-17 Feet	0-5 Feet	5-8 Feet	0-5 Feet	5-10 Feet	10-13.5 Feet	10-15 Feet	15-20 Feet	5-9 Feet	10-13 Feet	5-10 Feet	10-15 Feet
Sample Depth Relative to October 1, 2016	0-5 Feet	5-10 Feet	10-15 Feet	15-17 Feet	0-5 Feet	5-8 Feet	0-5 Feet	5-10 Feet	10-13.5 Feet	10-15 Feet	15-20 Feet	5-9 Feet	10-13 Feet	5-10 Feet	10-15 Feet
NOTES:															
MADEP-EPH-04-1.1 (mg/Kg dry)															
C9-C18 ALIPHATICS		20	110	200		ND (11)	28	860	110	63	ND (11)	ND (11)			
C19-C36 ALIPHATICS		70	370	730		32	180	1200	500	330	ND (11)	18			
C11-C22 AROMATICS		220	570	**1600**		67	390	**2400**	1000	560	ND (11)	48			
ACENAPHTHENE		1.3	ND (0.53)	ND (0.53)		ND (0.11)	1.6	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.32			
ACENAPHTHYLENE		ND (0.11)	ND (0.53)	ND (0.53)		ND (0.11)	ND (0.22)	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	ND (0.11)			
ANTHRACENE		2.5	ND (0.53)	ND (0.53)		ND (0.11)	3	ND (0.52)	ND (0.55)	0.28	ND (0.11)	0.32			
BENZO(A)ANTHRACENE		6	ND (0.53)	ND (0.53)		0.14	6.7	ND (0.52)	ND (0.55)	0.53	ND (0.11)	1.2			
BENZO(A)PYRENE		**5.1**	ND (0.53)	ND (0.53)		0.12	**6.3**	ND (0.52)	ND (0.55)	0.64	ND (0.11)	1.3			
BENZO(B)FLUORANTHENE		7	ND (0.53)	ND (0.53)		0.23	***8.3***	ND (0.52)	ND (0.55)	0.85	ND (0.11)	1.6			
BENZO(G,H,I)PERYLENE		2.7	ND (0.53)	ND (0.53)		0.13	*3.2*	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.82			
BENZO(K)FLUORANTHENE		2.6	ND (0.53)	ND (0.53)		ND (0.11)	3.2	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.57			
CHRYSENE		6.7	ND (0.53)	ND (0.53)		0.28	*7.9*	ND (0.52)	ND (0.55)	0.74	ND (0.11)	1.3			
DIBENZ(A,H)ANTHRACENE		**0.9**	ND (0.53)	ND (0.53)		ND (0.11)	***1.2***	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.19			
FLUORANTHENE		*14*	ND (0.53)	ND (0.53)		0.3	*18*	1.8	ND (0.55)	1.8	ND (0.11)	2.8			
FLUORENE		1.3	ND (0.53)	ND (0.53)		ND (0.11)	1.7	1.5	ND (0.55)	ND (0.24)	ND (0.11)	0.15			
INDENO(1,2,3-CD)PYRENE		*3.3*	ND (0.53)	ND (0.53)		ND (0.11)	*3.9*	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.79			
2-METHYLNAPHTHALENE		**0.99**	ND (0.53)	ND (0.53)		ND (0.11)	0.39	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	ND (0.11)			
NAPHTHALENE		0.44	ND (0.53)	ND (0.53)		ND (0.11)	0.41	ND (0.52)	ND (0.55)	ND (0.24)	ND (0.11)	0.18			
PHENANTHRENE		**11**	ND (0.53)	ND (0.53)		0.37	**14**	3.3	ND (0.55)	0.41	ND (0.11)	1.9			
PYRENE		13	ND (0.53)	ND (0.53)		0.37	17	ND (0.52)	ND (0.55)	1.7	ND (0.11)	2.7			
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)															
DIBENZOFURAN (see notes 7, 9)															
DI-N-BUTYLPHTHALATE (see note 7)															
MADEP-VPH-04-1.1 (mg/Kg dry)															
C5-C8 ALIPHATICS															
C9-C12 ALIPHATICS															
C9-C10 AROMATICS															
BENZENE															
ETHYLBENZENE															
METHYL TERT-BUTYL ETHER (MTBE)															
NAPHTHALENE															
TOLUENE															
M/P-XYLENE															
O-XYLENE															

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-19 (0-5)	B-19 (5-10)	B-19 (10-15)	B-19 (15-17)	B-20 (0-5)	B-20 (5-8)	B-21 (0-5)	B-21 (5-10)	B-21 (10-13.5)	B-22 (10-15)	B-22 (15-20)	B-23 (5-9)	B-26 (10-13)	B-27 (5-10)	B-28 (10-15)
SW-846 6010C/D (mg/Kg dry) Metals Digestion															
ANTIMONY															
ARSENIC															
BARIUM															
BERYLLIUM															
CADMIUM															
CHROMIUM (as +3)															
LEAD															
NICKEL															
SELENIUM															
SILVER															
THALLIUM															
VANADIUM															
ZINC															
SW-846 7471B (mg/Kg dry) Metals Digestion															
MERCURY															
SW-846 7196A (mg/Kg dry)															
CHROMIUM +6															
SW-846 8082A (mg/Kg dry)															
PCB 1016	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1221	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1232	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1242	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1248	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1254	**6.7**	**2.1**	ND (0.11)		ND (0.11)		**11**	0.63	ND (0.11)						
PCB 1260	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	0.12	ND (0.11)						
PCB 1262	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
PCB 1268	ND (1.1) *	ND (0.42)	ND (0.11)		ND (0.11)		ND (2.2) *	ND (0.11)	ND (0.11)						
TOTAL PCBs	**6.7**	**2.1**	ND (0.11)		ND (0.11)		**11**	0.75	ND (0.11)						

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-19 (0-5)	B-19 (5-10)	B-19 (10-15)	B-19 (15-17)	B-20 (0-5)	B-20 (5-8)	B-21 (0-5)	B-21 (5-10)	B-21 (10-13.5)	B-22 (10-15)	B-22 (15-20)	B-23 (5-9)	B-26 (10-13)	B-27 (5-10)	B-28 (10-15)
SW-846 8081B (mg/Kg dry)															
ALDRIN															
ALPHA-BHC															
BETA-BHC															
DELTA-BHC															
GAMMA-BHC (LINDANE)															
CHLORDANE															
4,4'-DDD															
4,4'-DDE															
4,4'-DDT															
DIELDRIN															
ENDOSULFAN I															
ENDOSULFAN II															
ENDOSULFAN SULFATE															
ENDRIN															
ENDRIN KETONE															
HEPTACHLOR															
HEPTACHLOR EPOXIDE															
HEXACHLOROBENZENE															
METHOXYCHLOR															
SW-846 8151A (mg/kg dry)															
2,4-D															
2,4-DB															
2,4,5-TP (SILVEX)															
2,4,5-T															
DALAPON															
DICAMBA															
DICHLOROPROP															
DINOSEB															
MCPA															
MCPP															
NOTES:															
1. An asterisk (*) following a detection limit															
indicates that the minimum laboratory reporting															
limit exceeds one or more of the regul. criteria.															
2. ND = Not detected above the lab reporting															
limits shown in parenthesis.															
3. NT = Not tested.															
4. ~ = No Method 1 Standard or UCL available															
5. Bolded values exceed the Method 1 Cleanup															
Standards (exclusive of S-x/GW-1).															
6. Italic values exceed MassDEP published															
background conc. for soils assoc. with fill															
containing coal ash or wood ash.															

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SAMPLING LOCATION														
	B-19 (0-5)	B-19 (5-10)	B-19 (10-15)	B-19 (15-17)	B-20 (0-5)	B-20 (5-8)	B-21 (0-5)	B-21 (5-10)	B-21 (10-13.5)	B-22 (10-15)	B-22 (15-20)	B-23 (5-9)	B-26 (10-13)	B-27 (5-10)	B-28 (10-15)

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SUMMARY STATISTICS			EVALUATION	
	Number	Number	Maximum Concentration	Does Maximum	Soil
Sampling Date	Analyzed	Detected	Detected	Concentration	Contaminant
Sample Depth Relative to Original Grade on March 2016				Exceed Background Concentration	of Concern
Sample Depth During Investigative Event				for Fill?	
Sample Depth Relative to October 1, 2016					
NOTES:					
MADEP-EPH-04-1.1 (mg/Kg dry)					
C9-C18 ALIPHATICS	50	32	8300	Not applicable	Yes
C19-C36 ALIPHATICS	50	44	11000	Not applicable	Yes
C11-C22 AROMATICS	50	48	15000	Not applicable	Yes
ACENAPHTHENE	51	19	2.6	Yes	Yes
ACENAPHTHYLENE	51	4	0.77	No	Yes - a
ANTHRACENE	51	30	11	Yes	Yes
BENZO(A)ANTHRACENE	51	31	15	Yes	Yes
BENZO(A)PYRENE	51	33	15	Yes	Yes
BENZO(B)FLUORANTHENE	51	33	19	Yes	Yes
BENZO(G,H,I)PERYLENE	51	31	8.7	Yes	Yes
BENZO(K)FLUORANTHENE	51	26	7	Yes	Yes
CHRYSENE	51	35	15	Yes	Yes
DIBENZ(A,H)ANTHRACENE	51	12	2.3	Yes	Yes
FLUORANTHENE	51	41	31	Yes	Yes
FLUORENE	51	25	29	Yes	Yes
INDENO(1,2,3-CD)PYRENE	51	29	10	Yes	Yes
2-METHYLNAPHTHALENE	51	18	65	Yes	Yes
NAPHTHALENE	51	21	27	Yes	Yes
PHENANTHRENE	51	41	35	Yes	Yes
PYRENE	51	38	31	Yes	Yes
BIS(2-ETHYLHEXYL)PHTHALATE (see note 7)	1	0	0	Not applicable	No - c
DIBENZOFURAN (see notes 7, 9)	1	1	0.37	Not applicable	No - b
DI-N-BUTYLPHTHALATE (see note 7)	1	0	0	Not applicable	No - c
MADEP-VPH-04-1.1 (mg/Kg dry)					
C5-C8 ALIPHATICS	14	0	0		
C9-C12 ALIPHATICS	14	0	0		
C9-C10 AROMATICS	14	3	100		
BENZENE	14	5	0.52	Not applicable	Yes - f
ETHYLBENZENE	14	0	0		
METHYL TERT-BUTYL ETHER (MTBE)	14	0	0		
NAPHTHALENE	14	0	0		
TOLUENE	14	7	0.6	Not applicable	Yes - f
M/P-XYLENE	14	0	0		
O-XYLENE	14	0	0		

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SUMMARY STATISTICS			EVALUATION	
	Number	Number	Maximum Concentration	Does Maximum	Soil
SW-846 6010C/D (mg/Kg dry) Metals Digestion					
ANTIMONY	19	1	3	No	No
ARSENIC	23	22	19	No	No - c
BARIUM	19	19	160	Yes	Yes
BERYLLIUM	19	10	25	Yes	Yes
CADMIUM	19	18	1.4	No	No - c
CHROMIUM (as +3)	19	19	50	Yes	Yes
LEAD	23	23	1300	Yes	Yes
NICKEL	19	19	85	Yes	Yes
SELENIUM	19	0			
SILVER	19	0			
THALLIUM	19	1	9.8	Yes	Yes - d
VANADIUM	38	38	2100	Yes	Yes
ZINC	19	19	260	Yes	Yes
SW-846 7471B (mg/Kg dry) Metals Digestion					
MERCURY	19	17	1.3	Yes	No - e
SW-846 7196A (mg/Kg dry)					
CHROMIUM +6	0	0			
SW-846 8082A (mg/Kg dry)					
PCB 1016					
PCB 1221					
PCB 1232					
PCB 1242					
PCB 1248					
PCB 1254					
PCB 1260					
PCB 1262					
PCB 1268					
TOTAL PCBs	73	53	42	Not applicable	Yes

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SUMMARY STATISTICS			EVALUATION	
	Number	Number	Maximum Concentration	Does Maximum	Soil
SW-846 8081B (mg/Kg dry)					
ALDRIN	19	0			
ALPHA-BHC	19	0			
BETA-BHC	19	0			
DELTA-BHC	19	0			
GAMMA-BHC (LINDANE)	19	0			
CHLORDANE	19	1	0.045	Not applicable	Yes
4,4'-DDD	19	0			
4,4'-DDE	19	1	0.093	Not applicable	Yes
4,4'-DDT	19	6	0.16	Not applicable	Yes
DIELDRIN	19	4	0.19	Not applicable	Yes
ENDOSULFAN I	19	0			
ENDOSULFAN II	19	0			
ENDOSULFAN SULFATE	19	0			
ENDRIN	19	0			
ENDRIN KETONE	19	0			
HEPTACHLOR	19	0			
HEPTACHLOR EPOXIDE	19	0			
HEXACHLOROBENZENE	19	0			
METHOXYCHLOR	19	0			
SW-846 8151A (mg/kg dry)					
2,4-D	7	0			
2,4-DB	7	0			
2,4,5-TP (SILVEX)	7	0			
2,4,5-T	7	0			
DALAPON	7	0			
DICAMBA	7	0			
DICHLOROPROP	7	0			
DINOSEB	7	0			
MCPA	7	0			
MCPP	7	0			

NOTES:

1. An asterisk (*) following a detection limit indicates that the minimum laboratory reporting limit exceeds one or more of the regul. criteria.
2. ND = Not detected above the lab reporting limits shown in parenthesis.
3. NT = Not tested.
4. ~ = No Method 1 Standard or UCL available
5. Bolded values exceed the Method 1 Cleanup Standards (exclusive of S-x/GW-1).
6. Italic values exceed MassDEP published background conc. for soils assoc. with fill containing coal ash or wood ash.

a. This PAH is a contaminant of concern, because most related PAHs are contaminants of concern.

b. Dibenzofuran is a component of EPH; therefore, its risk is not evaluated separately.

c. These compounds were only detected in one soil sample at levels above there published background concentration for soils associated with fill containing coal ash or wood ash. This soil sample was collected from stockpile SP-1 (shallow soils scraped from courtyard) and are going to be removed from the property. Therefore, these metals are not soil contaminants of concern.

d. Thallium was detected at a level above its published background concentration in only one soil sample, collected from the stockpile of soils originating from the fuel oil vault sands. Thallium is a contaminant of concern only for SP-3 (to determine whether these soils can be re-used on-Site.

e. Mercury is not a contaminant of concern, because it was detected in only 2 of 20 soil samples, and only slightly above its background concentration.

f. Only detected in subsurface soils impacted with petroleum. Therefore,

Table N-1
Comparison of Soil Analytical Data to Published Background Concentrations Identification of Soil Contaminants of Concern
(December 2016)

Parameter	SUMMARY STATISTICS			EVALUATION	
	Number	Number	Maximum Concentration	Does Maximum	Soil
	retained as contaminant of concern for petroleum-contaminated soils.				

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATION											
	S-1	S-2	S-3		B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-8 (0-1')	B-8 (1-3')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (5'E) (0-1)
Sampling Date					3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	9/30/2016
Sample Depth Relative to Original Grade on March 2016					0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet
Sample Depth During Investigative Event					0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet
Sample Depth Relative to October 1, 2016					Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled	0-2 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet
NOTES:					11	11	11	11	11	10, 11	11					
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS	1000	3000	5000	20000			24			61					6	
C19-C36 ALIPHATICS	3000	5000	5000	20000			160			140					6	
C11-C22 AROMATICS	1000	3000	5000	10000			310			180					37	
ACENAPHTHENE	1000	3000	5000	10000			1.4			*2.6*					0.06	
ACENAPHTHYLENE	1000	3000	5000	10000			0.37			0.38					0.06	
ANTHRACENE	1000	3000	5000	10000			3.4			*5.4*					0.12	
BENZO(A)ANTHRACENE	7	40	300	3000			**7.4**			***11***					0.21	
BENZO(A)PYRENE	2	7	30	300			**6.5**			***9.3***					0.22	
BENZO(B)FLUORANTHENE	7	40	300	3000			***9.1***			***12***					0.35	
BENZO(G,H,I)PERYLENE	1000	3000	5000	10000			*3.4*			*5.0*					0.13	
BENZO(K)FLUORANTHENE	70	400	3000	10000			3.0			*4.6*					0.06	
CHRYSENE	70	400	3000	10000			*8.5*			*12*					0.30	
DIBENZ(A,H)ANTHRACENE	0.7	4	30	300			***1.1***			***1.7***					0.06	
FLUORANTHENE	1000	3000	5000	10000			*18*			*26*					0.44	
FLUORENE	1000	3000	5000	10000			1.9			*3.4*					0.06	
INDENO(1,2,3-CD)PYRENE	7	40	300	3000			*4.1*			*5.1*					0.12	
2-METHYLNAPHTHALENE	300	500	500	5000			0.67			0.96					0.06	
NAPHTHALENE	500	1000	3000	10000			*1.7*			*1.5*					0.06	
PHENANTHRENE	500	1000	3000	10000			15			*23*					0.51	
PYRENE	1000	3000	5000	10000			17			*22*					0.49	
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
BARIUM	1000	3000	5000	10000			*120*			*91*						
BERYLLIUM	90	200	200	2000			*1.4*			*1.3*						
CHROMIUM (as +3)	1000	3000	5000	10000			34			*50*						
LEAD	200	600	600	6000			100			150						
NICKEL	600	1000	1000	10000			29			26						
VANADIUM	400	700	700	7000			*110*			*66*					*390*	
ZINC	1000	3000	5000	1000			200			260						
SW-846 8082A (mg/Kg dry)																
TOTAL PCBs	1	4	4	100	**7.0**	**3.7**		**8.5**	**6.0**	0.05	**39**	0.05	**42**	**1.1**		**22.2**

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATION											
	S-1	S-2	S-3		B-5 (0-1')	B-5 (1-3')	B-5 (0-3')	B-7 (0-1')	B-7 (1-3')	B-7 (0-3')	B-8 (0-1')	B-8 (1-3')	B-9 (0-1')	B-9 (1-3')	B-9 (0-3')	B-9 (5'E) (0-1)
SW-846 8081B (mg/Kg dry)																
CHLORDANE	5	5	5	500			ND (0.47)			ND (0.47)						
4,4'-DDE	6	30	60	600			0.047			0.047						
4,4'-DDT	6	30	60	600			0.047			0.11						
DIELDRIN	0.08	0.5	3	30			0.047			0.047						
NOTES:																
1. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
2. When calculating exposure point																
concentration, if no compound detected, one-																
half the lab reporting was used instead of zero.																

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION															
	B-9 (5'E) (1-3)	**B-9 (5'N) (0-1)**	**B-9 (5'S) (0-1)**	**B-9 (5'W) (0-1)**	**B-10 (0-1')**	**B-10 (1-3')**	**B-10 (0-3')**	**B-11 (0-1')**	**B-11 (1-3')**	**B-11-r10B (0-1')**	**B-11-r10B (0-3')**	**B-11-r10B (1-3')**	**B-11-r5A (0-1')**	**B-11-r5A (0-3')**	**B-11-r5A (1-3')**	**B-11-r5B (0-1')**
Sampling Date	9/30/2016	9/30/2016	9/30/2016	9/30/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016
Sample Depth Relative to Original Grade on March 2016	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet
Sample Depth During Investigative Event	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	0-1 Feet
Sample Depth Relative to October 1, 2016	1-3 Feet	0-1 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	Excavated/ Transported Off-Site	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	Excavated/ Transported Off-Site	0-2 Feet	0-2 Feet	Excavated/ Transported Off-Site
NOTES:							10	7					7			7
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS							18				180			42		
C19-C36 ALIPHATICS							150				530			230		
C11-C22 AROMATICS							190				**1100**			400		
ACENAPHTHENE							0.49				0.115			0.46		
ACENAPHTHYLENE							0.23				0.115			0.77		
ANTHRACENE							1.1				0.38			4		
BENZO(A)ANTHRACENE							2.1				0.74			**15**		
BENZO(A)PYRENE							1.4				0.68			**15**		
BENZO(B)FLUORANTHENE							2.4				0.115			**19**		
BENZO(G,H,I)PERYLENE							1.1				0.89			8.7		
BENZO(K)FLUORANTHENE							0.67				0.115			7		
CHRYSENE							2.4				1.3			15		
DIBENZ(A,H)ANTHRACENE							0.23				0.115			**2.3**		
FLUORANTHENE							4.1				1.7			31		
FLUORENE							0.57				0.115			0.6		
INDENO(1,2,3-CD)PYRENE							1.1				0.115			**10**		
2-METHYLNAPHTHALENE							0.23				0.115			0.31		
NAPHTHALENE							0.23				0.115			1.2		
PHENANTHRENE							4.7				1.7			**11**		
PYRENE							4.1				1.2			31		
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
BARIUM							*64*									
BERYLLIUM							*25*									
CHROMIUM (as +3)							26									
LEAD							68									
NICKEL							*64*									
VANADIUM							***2100***				*380*			*140*		
ZINC							65									
SW-846 8082A (mg/Kg dry)																
TOTAL PCBs	**15.2**	**9.1**	**36.5**	**24.4**	**21**	0.29			0.16	**7.0**		0.48			**5.4**	

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION															
	B-9 (5'E) (1-3)	B-9 (5'N) (0-1)	B-9 (5'S) (0-1)	B-9 (5'W) (0-1)	B-10 (0-1')	B-10 (1-3')	B-10 (0-3')	B-11 (0-1')	B-11 (1-3')	B-11-r10B (0-1')	B-11-r10B (0-3')	B-11-r10B (1-3')	B-11-r5A (0-1')	B-11-r5A (0-3')	B-11-r5A (1-3')	B-11-r5B (0-1')
SW-846 8081B (mg/Kg dry)																
CHLORDANE							ND (0.46)									
4,4'-DDE							0.046									
4,4'-DDT							0.046									
DIELDRIN							0.046									
NOTES:																
1. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
2. When calculating exposure point																
concentration, if no compound detected, one-																
half the lab reporting was used instead of zero.																

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	**B-11-r5B (1-3')**	**B-11-r5C (0-1')**	**B-11-r5C (0-3')**	**B-11-r5C (1-3')**	**Btm-B11-ex**	**ESW-B11-ex**	**WSW-B11-ex**	**B-12 (0-1')**	**B-12 (1-3')**	**B-12 (0-3')**	**B-13 (0-1')**	**B-13 (1-3')**	**B-13 (0-3')**	**SP-1**	**SP-3**
Sampling Date	3/30/2016	3/30/2016	3/30/2016	3/30/2016	3/30/2016	5/27/2016	5/27/2016	5/27/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	3/23/2016	2/29/2016	3/29/2016
Sample Depth Relative to Original Grade on March 2016	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	1-1.5 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	Stockpile / Top Soils	Stockpile
Sample Depth During Investigative Event	0-3 Feet	1-3 Feet	0-1 Feet	0-3 Feet	1-3 Feet	1-1.5 Feet	0-1 Feet	0-1 Feet	0-1 Feet	1-3 Feet	0-3 Feet	0-1 Feet	1-3 Feet	0-3 Feet	Stockpile / Top Soils	Stockpile / Sands in vault
Sample Depth Relative to October 1, 2016	0-2 Feet	0-2 Feet	Excavated/ Transported Off-Site	0-2 Feet	0-2 Feet	0-0.5 Feet	0-1 Feet	0-1 Feet	Excavated and Put in Dry Well	0-2 Feet	0-2 Feet	Excavated and Put in Dry Well	0-2 Feet	0-2 Feet	Removed from Site	Stockpile / Sands in vault
NOTES:			7			12	12	12	16	15	15	16	15	15	7	9
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS	24			57							15.5			17		
C19-C36 ALIPHATICS	120			310							65			80		
C11-C22 AROMATICS	97			290							130			240		
ACENAPHTHENE	0.58			0.49							1.3			1.1		0.70
ACENAPHTHYLENE	0.115			0.12							0.075			0.07		0.09
ANTHRACENE	0.86			0.88							2.3			0.42		1.5
BENZO(A)ANTHRACENE	1.4			1.5							2.8			0.60		3.0
BENZO(A)PYRENE	1.2			1.6							**2.2**			1.0		**2.6**
BENZO(B)FLUORANTHENE	1.5			2							3.4			0.84		3.5
BENZO(G,H,I)PERYLENE	0.58			0.98							0.93			0.32		1.4
BENZO(K)FLUORANTHENE	0.53			0.78							1.4			0.28		1.4
CHRYSENE	1.6			1.8							2.8			2.6		2.8
DIBENZ(A,H)ANTHRACENE	0.115			0.12							0.41			0.35		0.59
FLUORANTHENE	3.3			5.1							7.8			1.8		7.0
FLUORENE	0.41			0.42							1.3			0.17		0.93
INDENO(1,2,3-CD)PYRENE	0.7			1							1.2			1.5		1.4
2-METHYLNAPHTHALENE	0.115			0.28							0.45			0.07		0.29
NAPHTHALENE	0.115			0.88							0.98			0.68		0.59
PHENANTHRENE	4			3.2							8.8			6.9		5.9
PYRENE	3.5			3.7							7.1			6.4		5.0
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
BARIUM																50
BERYLLIUM																0.73
CHROMIUM (as +3)																30
LEAD											**210**			***1300***		25
NICKEL																18
VANADIUM	***550***			***640***							20			*35*		33
ZINC																43
SW-846 8082A (mg/Kg dry)																
TOTAL PCBs		0.19			**2.9**	0.79	0.38	**1.1**	**11**	0.26		**12**	**25**			**2.6**

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION															
	B-11-r5B (0-3')	B-11-r5B (1-3')	B-11-r5C (0-1')	B-11-r5C (0-3')	B-11-r5C (1-3')	Btm-B11-ex	ESW-B11-ex	WSW-B11-ex	B-12 (0-1')	B-12 (1-3')	B-12 (0-3')	B-13 (0-1')	B-13 (1-3')	B-13 (0-3')	SP-1	SP-3
SW-846 8081B (mg/Kg dry)																
CHLORDANE																ND (0.021)
4,4'-DDE																0.0021
4,4'-DDT																0.019
DIELDRIN																0.0021
NOTES:																
1. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
2. When calculating exposure point																
concentration, if no compound detected, one-																
half the lab reporting was used instead of zero.																

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION		
	FO-1-TP (0-1')	**FO-1-TP (1-2')**	**FO-1-TP (2-3')**
Sampling Date	3/9/2016	3/9/2016	3/9/2016
Sample Depth Relative to Original Grade on March 2016	0-1 Feet	1-2 Feet	2-3 Feet
Sample Depth During Investigative Event	0-1 Feet (below grade / above vault)	1-2 Feet (below grade / above vault)	2-3 Feet (below grade / above vault)
Sample Depth Relative to October 1, 2016	Excavated and Stockpiled	Excavated and Stockpiled	Excavated and Stockpiled
NOTES:			
MADEP-EPH-04-1.1 (mg/Kg dry)			
C9-C18 ALIPHATICS			
C19-C36 ALIPHATICS			
C11-C22 AROMATICS			
ACENAPHTHENE			
ACENAPHTHYLENE			
ANTHRACENE			
BENZO(A)ANTHRACENE			
BENZO(A)PYRENE			
BENZO(B)FLUORANTHENE			
BENZO(G,H,I)PERYLENE			
BENZO(K)FLUORANTHENE			
CHRYSENE			
DIBENZ(A,H)ANTHRACENE			
FLUORANTHENE			
FLUORENE			
INDENO(1,2,3-CD)PYRENE			
2-METHYLNAPHTHALENE			
NAPHTHALENE			
PHENANTHRENE			
PYRENE			
SW-846 6010C/D (mg/Kg dry) Metals Digestion			
BARIUM	*140*	*95*	*130*
BERYLLIUM	0.68	0.39	*1.9*
CHROMIUM (as +3)	36	31	37
LEAD	**340**	***1100***	**220**
NICKEL	*32*	22	29
VANADIUM	*160*	*96*	*140*
ZINC	250	160	190
SW-846 8082A (mg/Kg dry)			
TOTAL PCBs	**13**	**12**	**7.8**

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION		
	FO-1-TP (0-1')	FO-1-TP (1-2')	FO-1-TP (2-3')
SW-846 8081B (mg/Kg dry)			
CHLORDANE	ND (0.46)	ND (0.46)	ND (0.45)
4,4'-DDE	0.046	0.093	0.045
4,4'-DDT	0.15	0.13	0.13
DIELDRIN	**0.16**	**0.19**	**0.16**
NOTES:			
1. ND = Not detected above the lab reporting			
limits shown in parenthesis.			
2. When calculating exposure point			
concentration, if no compound detected, one-			
half the lab reporting was used instead of zero.			

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
Sampling Date	Analyzed	Detected	> S-2	Concentration	Derive	Concentration	(Population)	Confidence	Confidence	Concentration
Sample Depth Relative to Original Grade on March 2016		> S-2 Standard	Standard		EPC for S-2 Soils			Interval	Limit on the Mean	
Sample Depth During Investigative Event										
Sample Depth Relative to October 1, 2016										
NOTES:										
MADEP-EPH-04-1.1 (mg/Kg dry)										
C9-C18 ALIPHATICS	10	0	0	180	Mean	44				44
C19-C36 ALIPHATICS	10	0	0	530	Mean	179				179
C11-C22 AROMATICS	10	0	0	1100	Mean	297				297
ACENAPHTHENE	11	0	0	2.6	Mean	0.85				0.85
ACENAPHTHYLENE	11	0	0	0.77	Mean	0.22				0.22
ANTHRACENE	11	0	0	5.4	Mean	1.9				1.9
BENZO(A)ANTHRACENE	11	0	0	15	Mean	4.2				4.2
BENZO(A)PYRENE	11	2	18	15	Mean	3.8				3.8
BENZO(B)FLUORANTHENE	11	0	0	19	Mean	4.9				4.9
BENZO(G,H,I)PERYLENE	11	0	0	8.7	Mean	2.1				2.1
BENZO(K)FLUORANTHENE	11	0	0	7	Mean	1.8				1.8
CHRYSENE	11	0	0	15	Mean	4.6				4.6
DIBENZ(A,H)ANTHRACENE	11	0	0	2.3	Mean	0.64				0.64
FLUORANTHENE	11	0	0	31	Mean	9.7				9.7
FLUORENE	11	0	0	3.4	Mean	0.90				0.90
INDENO(1,2,3-CD)PYRENE	11	0	0	10	Mean	2.4				2.4
2-METHYLNAPHTHALENE	11	0	0	0.96	Mean	0.32				0.32
NAPHTHALENE	11	0	0	1.7	Mean	0.73				0.73
PHENANTHRENE	11	0	0	23	Mean	7.7				7.7
PYRENE	11	0	0	31	Mean	9.2				9.2
SW-846 6010C/D (mg/Kg dry) Metals Digestion										
BARIUM	7	0	0	140	Mean	99				99
BERYLLIUM	7	0	0	25	Mean	4.5				4.5
CHROMIUM (as +3)	7	0	0	50	Mean	35				35
LEAD	9	2	22	1300	Mean	390				390
NICKEL	7	0	0	64	Mean	31				31
VANADIUM	14	1	7.1	2100	Mean	347				347
ZINC	7	0	0	260	Mean	167				167
SW-846 8082A (mg/Kg dry)										
TOTAL PCBs	33	19	58	42	95th % UCL on Mean	10.2	11.7	4.00	14.24	14

Table N-2
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 0-3 Foot Interval
(December 2016)

Parameter	Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
SW-846 8081B (mg/Kg dry)										
CHLORDANE	7			none detected						
4,4'-DDE	7	0	0	0.093	Mean	0.047				0.047
4,4'-DDT	7	0	0	0.15	Mean	0.090				0.090
DIELDRIN	7	0	0	0.19	Mean	0.093				0.093
NOTES:										
1. ND = Not detected above the lab reporting										
limits shown in parenthesis.										
2. When calculating exposure point										
concentration, if no compound detected, one-										
half the lab reporting was used instead of zero.										

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATION											
	S-1	S-2	S-3		B-5 (3-6')	B-7 (3-6')	B-8 (3-6')	B-9 (3-6')	B-10 (3-6')	B-11 (3-6')	B-12 (3-6')	B-13 (3-6')	BTM-GT-1	ESW-GT-1	NSW-GT-1	NSW-GT-2
Sampling Date					3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/23/2016	3/23/2016	3/8/2016	3/8/2016	3/8/2016	3/8/2016
Sample Depth Relative to Original Grade on March 2016					3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	6 Feet	3-4 Feet	3-4 Feet	5-6 Feet
Sample Depth During Investigative Event					3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	3-6 Feet	6 Feet	3-4 Feet	3-4 Feet	5-6 Feet
Sample Depth Relative to October 1, 2016					0-3 Feet	0-3 Feet	2-5 Feet	3-6 Feet	3-6 Feet	3-6 Feet	2-5 Feet	2-5 Feet	3 Feet	0-1 Feet	0-1 Feet	2-3 Feet
NOTES:											15	15				
MADEP-EPH-04-1.1 (mg/Kg dry)																
C9-C18 ALIPHATICS	1000	3000	5000	20000	26	5.5		5.5	5.5		5.5	6	6	13	34	11
C19-C36 ALIPHATICS	3000	5000	5000	20000	64	28		5.5	19		16	19	6	29	140	77
C11-C22 AROMATICS	1000	3000	5000	10000	220	83		46	31		34	26	25	41	420	120
ACENAPHTHENE	1000	3000	5000	10000	0.76	0.54		0.055	0.055		0.39	0.93	0.06	0.055	1.7	0.37
ACENAPHTHYLENE	1000	3000	5000	10000	0.11	0.055		0.055	0.055		0.055	0.12	0.06	0.055	0.115	0.11
ANTHRACENE	1000	3000	5000	10000	1.8	1.4		0.38	0.055		0.52	1.5	0.06	0.055	*4.7*	0.73
BENZO(A)ANTHRACENE	7	40	300	3000	4.1	2.9		1.2	0.28		0.70	2.3	0.06	0.055	***10***	1.7
BENZO(A)PYRENE	2	7	30	300	**3.7**	**2.4**		1.0	0.29		0.67	1.9	0.27	0.055	***9.3***	0.69
BENZO(B)FLUORANTHENE	7	40	300	3000	5.3	3.3		1.3	0.38		0.85	2.5	0.32	0.055	***13***	2
BENZO(G,H,I)PERYLENE	1000	3000	5000	10000	1.7	1.2		0.54	0.18		0.36	0.96	0.38	0.055	*4.9*	0.96
BENZO(K)FLUORANTHENE	70	400	3000	10000	2.0	1.2		0.50	0.15		0.33	0.92	0.06	0.055	*4.8*	0.73
CHRYSENE	70	400	3000	10000	5.0	3.2		1.3	0.37		0.68	0.25	0.15	0.055	*12*	1.8
DIBENZ(A,H)ANTHRACENE	0.7	4	30	300	0.65	0.41		0.055	0.055		0.055	0.12	0.06	0.055	***1.5***	0.11
FLUORANTHENE	1000	3000	5000	10000	9.5	6.6		2.4	0.61		1.9	0.56	0.15	0.14	*27*	3.7
FLUORENE	1000	3000	5000	10000	0.90	0.78		0.055	0.055		0.22	0.74	0.06	0.055	*2.1*	0.37
INDENO(1,2,3-CD)PYRENE	7	40	300	3000	2.1	1.3		0.59	0.18		0.41	1.2	0.36	0.055	*5.2*	0.93
2-METHYLNAPHTHALENE	300	500	500	5000	0.29	0.22		0.055	0.055		0.055	0.12	0.06	0.055	0.48	0.11
NAPHTHALENE	500	1000	3000	10000	0.44	0.32		0.055	0.055		0.16	0.12	0.06	0.055	0.70	0.11
PHENANTHRENE	500	1000	3000	10000	7.4	6.1		1.4	0.55		1.8	5.9	0.34	0.4	19	3
PYRENE	1000	3000	5000	10000	8.8	5.9		2.3	0.71		1.7	0.51	0.06	0.13	*25*	3.4
MADEP-VPH-04-1.1 (mg/Kg dry)																
BENZENE	40	200	1000	10000									0.10	0.15	0.0215	0.021
TOLUENE	500	1000	3000	10000									0.60	0.23	0.14	0.021

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATION											
	S-1	S-2	S-3		B-5 (3-6')	B-7 (3-6')	B-8 (3-6')	B-9 (3-6')	B-10 (3-6')	B-11 (3-6')	B-12 (3-6')	B-13 (3-6')	BTM-GT-1	ESW-GT-1	NSW-GT-1	NSW-GT-2
SW-846 6010C/D (mg/Kg dry) Metals Digestion																
BARIUM	1000	3000	5000	10000				30		*160*			34	43	*72*	42
BERYLLIUM	90	200	200	2000				*6.7*		*11*			ND (0.29)	ND (0.28)	ND (0.26)	ND (0.28)
CHROMIUM (as +3)	1000	3000	5000	10000				14		33			11	14	26	19
LEAD	200	600	600	6000				26		200	120	34	100	**290**	**230**	64
NICKEL	600	1000	1000	10000				*42*		*85*			11	23	22	14
VANADIUM	400	700	700	7000	*55*	*31*	*39*	***510***	***560***	***900***	13	22	27	*36*	*100*	*32*
ZINC	1000	3000	5000	1000				81		180			37	210	140	89
SW-846 8082A (mg/Kg dry)																
TOTAL PCBs	1	4	4	100	**3.8**	**2.2**	0.055	0.055	0.79	**2.0**	0.37	0.06	0.055	0.055	**6.3**	**1.2**
SW-846 8081B (mg/Kg dry)																
CHLORDANE	5	5	5	500				0.23		0.235			0.0115	0.011	0.225	0.22
4,4'-DDE	6	30	60	600				ND (0.091)		ND (0.094)			ND (0.0046)	ND (0.0045)	ND (0.090)	ND (0.088)
4,4'-DDT	6	30	60	600				0.0455		0.16			0.0023	0.00225	0.045	0.044
DIELDRIN	0.08	0.5	3	30				0.0455		0.047			0.0023	0.00225	**0.11**	0.044
NOTES:																
1. ND = Not detected above the lab reporting																
limits shown in parenthesis.																
2. When calculating exposure point																
concentration, if no compound detected, one-																
half the lab reporting was used instead of zero.																

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION											
	SSW-GT-1	**SSW-GT-2**	**WSW-GT-2**	**FO-1 (3')**	**FO-1-BTM**	**B-14A (0-5)**	**B-15 (0-5)**	**B-16 (0-5)**	**B-18 (0-5)**	**B-19 (0-5)**	**B-20 (0-5)**	**B-21 (0-5)**
Sampling Date	3/8/2016	3/8/2016	3/8/2016	3/9/2016	3/10/2016	9/16/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/16/2016	9/16/2016
Sample Depth Relative to Original Grade on March 2016	3-4 Feet	5-6 Feet	5-6 Feet	3.5 Feet	5.5 Feet	3-8 Feet	3-8 Feet	3-8 Feet	3-8 Feet	3-8 Feet	3-8 Feet	3-8 Feet
Sample Depth During Investigative Event	3-4 Feet	5-6 Feet	5-6 Feet	3.5 Feet (just in vault)	Bottom of vault (5.5 feet below grade)	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet
Sample Depth Relative to October 1, 2016	0-1 Feet	2-3 Feet	2-3 Feet	0.5 Feet (just in vault)	Bottom of vault (2.5 feet below grade)	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet	0-5 Feet
NOTES:				8	8							
MADEP-EPH-04-1.1 (mg/Kg dry)												
C9-C18 ALIPHATICS	5.5	37	5.5	5		**2400**						28
C19-C36 ALIPHATICS	17	200	5.5	5		**3400**						180
C11-C22 AROMATICS	31	210	33	5		**7200**						390
ACENAPHTHENE	0.055	0.215	0.055	0.05		1.45						1.6
ACENAPHTHYLENE	0.055	0.215	0.055	0.05		1.45						ND (0.22)
ANTHRACENE	0.055	0.215	0.18	0.05		1.45						3
BENZO(A)ANTHRACENE	0.055	0.78	0.5	0.05		1.45						6.7
BENZO(A)PYRENE	0.24	0.94	0.52	0.05		1.45						**6.3**
BENZO(B)FLUORANTHENE	0.31	1.1	0.67	0.05		1.45						***8.3***
BENZO(G,H,I)PERYLENE	0.33	0.77	0.41	0.05		1.45						*3.2*
BENZO(K)FLUORANTHENE	0.055	0.44	0.26	0.05		1.45						3.2
CHRYSENE	0.17	1.0	0.59	0.05		1.45						*7.9*
DIBENZ(A,H)ANTHRACENE	0.055	0.215	0.055	0.05		1.45						***1.2***
FLUORANTHENE	0.19	1.6	1.1	0.05		*12*						*18*
FLUORENE	0.055	0.215	0.055	0.05		1.45						1.7
INDENO(1,2,3-CD)PYRENE	0.25	0.56	0.36	0.05		1.45						*3.9*
2-METHYLNAPHTHALENE	0.055	0.215	0.055	0.05		***12***						0.39
NAPHTHALENE	0.055	0.215	0.055	0.05		1.45						0.41
PHENANTHRENE	0.24	1.2	0.74	0.05		**12**						**14**
PYRENE	0.19	1.6	1	0.05		7.1						17
MADEP-VPH-04-1.1 (mg/Kg dry)												
BENZENE	0.026	0.0265	0.0205	0.02	0.021							
TOLUENE	0.25	0.087	0.0205	0.02	0.021							

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATION											
	SSW-GT-1	SSW-GT-2	WSW-GT-2	FO-1 (3')	FO-1-BTM	B-14A (0-5)	B-15 (0-5)	B-16 (0-5)	B-18 (0-5)	B-19 (0-5)	B-20 (0-5)	B-21 (0-5)
SW-846 6010C/D (mg/Kg dry) Metals Digestion												
BARIUM	27	31	28	32	30							
BERYLLIUM	ND (0.28)	ND (0.28)	ND (0.27)	0.63	ND (0.25)							
CHROMIUM (as +3)	12	18	11	25	20							
LEAD	58	59	40	7	6.3							
NICKEL	9.0	18	8.8	20	14							
VANADIUM	14	*50*	15	*32*	29							
ZINC	42	79	35	23	29							
SW-846 8082A (mg/Kg dry)												
TOTAL PCBs	0.055	0.35	0.16	0.05	0.055	0.075	**12**	0.90	**29**	**6.7**	0.055	**11**
SW-846 8081B (mg/Kg dry)												
CHLORDANE	0.011	0.215	0.045	0.0105	0.011							
4,4'-DDE	ND (0.0045)	ND (0.087)	ND (0.0044)	ND (0.0041)	ND (0.0043)							
4,4'-DDT	0.00225	0.0435	0.0022	0.00205	0.00215							
DIELDRIN	0.00225	0.0435	0.0022	0.00205	0.00215							
NOTES:												
1. ND = Not detected above the lab reporting												
limits shown in parenthesis.												
2. When calculating exposure point												
concentration, if no compound detected, one-												
half the lab reporting was used instead of zero.												

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
Sampling Date	Analyzed	Detected	> S-2	Concentration	Derive	Concentration	(Population)	Confidence	Confidence	Concentration
Sample Depth Relative to Original Grade on March 2016		> S-2 Standard	Standard		EPC for S-2 Soils			Interval	Limit on the Mean	
Sample Depth During Investigative Event										
Sample Depth Relative to October 1, 2016										
NOTES:										
MADEP-EPH-04-1.1 (mg/Kg dry)										
C9-C18 ALIPHATICS	16	0	0	2400	Mean	162				162
C19-C36 ALIPHATICS	16	0	0	3400	Mean	263				263
C11-C22 AROMATICS	16	1	6.3	7200	Mean	557				557
ACENAPHTHENE	16	0	0	1.7	Mean	0.52				0.52
ACENAPHTHYLENE	16	0	0	1.45	Mean	0.17				0.17
ANTHRACENE	16	0	0	4.7	Mean	1.0				1.0
BENZO(A)ANTHRACENE	16	0	0	10	Mean	2.1				2.1
BENZO(A)PYRENE	16	1	6.3	9.3	Mean	1.9				1.9
BENZO(B)FLUORANTHENE	16	0	0	13	Mean	2.6				2.6
BENZO(G,H,I)PERYLENE	16	0	0	4.9	Mean	1.1				1.1
BENZO(K)FLUORANTHENE	16	0	0	4.8	Mean	1.0				1.0
CHRYSENE	16	0	0	12	Mean	2.2				2.2
DIBENZ(A,H)ANTHRACENE	16	0	0	1.5	Mean	0.38				0.38
FLUORANTHENE	16	0	0	27	Mean	5.3				5.3
FLUORENE	16	0	0	2.1	Mean	0.55				0.55
INDENO(1,2,3-CD)PYRENE	16	0	0	5.2	Mean	1.2				1.2
2-METHYLNAPHTHALENE	16	0	0	12	Mean	0.89				0.89
NAPHTHALENE	16	0	0	1.45	Mean	0.27				0.27
PHENANTHRENE	16	0	0	19	Mean	4.6				4.6
PYRENE	16	0	0	25	Mean	4.7				4.7
MADEP-VPH-04-1.1 (mg/Kg dry)										
BENZENE	9	0	0	0.15	Mean	0.045				0.045
TOLUENE	9	0	0	0.60	Mean	0.154				0.154

Table N-3
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 3-6 Foot Interval
(December 2016)

Parameter	Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
SW-846 6010C/D (mg/Kg dry) Metals Digestion										
BARIUM	11	0	0	160	Mean	48				48
BERYLLIUM	11	0	0	11	Mean	6.1				6.1
CHROMIUM (as +3)	11	0	0	33	Mean	18				18
LEAD	13	0	0	290	Mean	95				95
NICKEL	11	0	0	85	Mean	24				24
VANADIUM	17	1	5.9	900	Mean	145				145
ZINC	11	0	0	210	Mean	86				86
SW-846 8082A (mg/Kg dry)										
TOTAL PCBs	24	5	21	29	95th% UCL on Mean	3.2	6.35	0.87	4.10	4.1
SW-846 8081B (mg/Kg dry)										
CHLORDANE	11	0	0	0.235	Mean	0.11				0.11
4,4'-DDE	11			None Detected						
4,4'-DDT	11	0	0	0.16	Mean	0.032				0.032
DIELDRIN	11	0	0	0.11	Mean	0.028				0.028
NOTES:										
1. ND = Not detected above the lab reporting										
limits shown in parenthesis.										
2. When calculating exposure point										
concentration, if no compound detected, one-										
half the lab reporting was used instead of zero.										

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATIONS										
	S-1	S-2	S-3		B-5 (6-11')	B-7 (6-11')	B-8 (6-11')	B-9 (6-9')	B-10 (6-11')	B-11 (6-11')	BTM-GT-1	BTM-GT-2	B-14 (10-15)	B-14A (5-10)	B-14A (10-15)
Sampling Date					3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/14/2016	3/8/2016	3/8/2016	9/15/2016	9/16/2016	9/16/2016
Sample Depth Relative to Original Grade on March 2016					6-11 Feet	6-11 Feet	6-11 Feet	6-9 Feet	6-11 Feet	6-11 Feet	6 Feet	8 Feet	13-18 Feet	8-13 Feet	13-18 Feet
Sample Depth During Investigative Event					6-11 Feet	6-11 Feet	6-11 Feet	6-9 Feet	6-11 Feet	6-11 Feet	6 Feet	8 Feet	10-15 Feet	5-10 Feet	10-15 Feet
Sample Depth Relative to October 1, 2016					3-8 Feet	3-8 Feet	5-10 Feet	6-9 Feet	6-11 Feet	6-11 Feet	3 Feet	5 Feet	10-15 Feet	5-10 Feet	10-15 Feet
NOTES:															
MADEP-EPH-04-1.1 (mg/Kg dry)															
C9-C18 ALIPHATICS	1000	3000	5000	20000	300	11				6	6	5.5		**1300**	**8300**
C19-C36 ALIPHATICS	3000	5000	5000	20000	750	48				46	6	31		2100	**11000**
C11-C22 AROMATICS	1000	3000	5000	10000	**1400**	83				51	25	45		**2500**	**15000**
ACENAPHTHENE	1000	3000	5000	10000	0.245	0.11				0.06	0.06	0.055		0.28	1.2
ACENAPHTHYLENE	1000	3000	5000	10000	0.245	0.11				0.06	0.06	0.055		0.28	1.2
ANTHRACENE	1000	3000	5000	10000	0.245	0.29				0.24	0.06	0.055		1.4	*11*
BENZO(A)ANTHRACENE	7	40	300	3000	0.245	1.2				0.54	0.06	0.055		0.28	1.2
BENZO(A)PYRENE	2	7	30	300	0.245	1.1				0.54	0.27	0.11		0.28	1.2
BENZO(B)FLUORANTHENE	7	40	300	3000	0.245	1.3				0.68	0.32	0.15		0.28	1.2
BENZO(G,H,I)PERYLENE	1000	3000	5000	10000	0.245	0.66				0.24	0.38	0.055		0.28	1.2
BENZO(K)FLUORANTHENE	70	400	3000	10000	0.245	0.52				0.25	0.06	0.055		0.28	1.2
CHRYSENE	70	400	3000	10000	0.245	1.3				0.61	0.15	0.11		0.28	1.2
DIBENZ(A,H)ANTHRACENE	0.7	4	30	300	0.245	0.11				0.06	0.06	0.055		0.28	1.2
FLUORANTHENE	1000	3000	5000	10000	1.2	2.3				1.3	0.15	0.17		4.6	*22*
FLUORENE	1000	3000	5000	10000	0.245	0.11				0.06	0.06	0.055		*3.1*	*29*
INDENO(1,2,3-CD)PYRENE	7	40	300	3000	0.245	0.56				0.32	0.36	0.055		0.28	1.2
2-METHYLNAPHTHALENE	300	500	500	5000	0.70	0.11				0.06	0.06	0.055		***5.7***	***65***
NAPHTHALENE	500	1000	3000	10000	0.79	0.11				0.06	0.06	0.055		*3.1*	***27***
PHENANTHRENE	500	1000	3000	10000	1.6	1.2				1.1	0.34	0.055		4.0	***35***
PYRENE	1000	3000	5000	10000	0.245	2.4				1.4	0.06	0.18		1.7	12
MADEP-VPH-04-1.1 (mg/Kg dry)															
BENZENE	40	200	1000	10000							0.10	0.058			
TOLUENE	500	1000	3000	10000							0.60	0.32			

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limits	SAMPLING LOCATIONS										
	S-1	S-2	S-3		B-5 (6-11')	B-7 (6-11')	B-8 (6-11')	B-9 (6-9')	B-10 (6-11')	B-11 (6-11')	BTM-GT-1	BTM-GT-2	B-14 (10-15)	B-14A (5-10)	B-14A (10-15)
SW-846 6010C/D (mg/Kg dry) Metals Digestion															
BARIUM	1000	3000	5000	10000							34	27			
BERYLLIUM	90	200	200	2000							0.145	0.135			
CHROMIUM (as +3)	1000	3000	5000	10000							11	10			
LEAD	200	600	600	6000							100	41			
NICKEL	600	1000	1000	10000							11	8.9			
VANADIUM	400	700	700	7000	30	14	*41*	*120*	*260*	***870***	27	14			
ZINC	1000	3000	5000	1000							37	43			
SW-846 8082A (mg/Kg dry)															
TOTAL PCBs	1	4	4	100	0.29	0.055	0.055	0.055	0.22	**6.2**	0.055	0.055		0.14	0.14
SW-846 8081B (mg/Kg dry)															
CHLORDANE	5	5	5	500							ND (0.023)	ND (0.22)			
4,4'-DDE	6	30	60	600							ND (0.0046)	ND (0.044)			
4,4'-DDT	6	30	60	600							ND (0.0046)	ND (0.044)			
DIELDRIN	0.08	0.5	3	30							ND (0.0046)	ND (0.044)			
NOTES:															
1. ND = Not detected above the lab reporting															
limits shown in parenthesis.															
2. When calculating exposure point															
concentration, if no compound detected, one-															
half the lab reporting was used instead of zero.															

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATIONS													
	B-14A (10-15)	**B-15 (5-10)**	**B-16 (5-10)**	**B-16 (10-15)**	**B-17 (5-7.5)**	**B-18 (5-10)**	**B-18 (10-15)**	**B-19 (5-10)**	**B-19 (10-15)**	**B-20 (5-8)**	**B-21 (5-10)**	**B-21 (10-13.5)**	**B-22 (10-15)**	**B-23 (5-9)**
Sampling Date	9/16/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/15/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016	9/16/2016
Sample Depth Relative to Original Grade on March 2016	13-18 Feet	8-13 Feet	8-13 Feet	13-18 Feet	8-10.5 Feet	8-10 Feet	13-18 Feet	8-13 Feet	13-18 Feet	8-11 Feet	8-13 Feet	13-16.5 Feet	11-16 Feet	6-10 Feet
Sample Depth During Investigative Event	10-15 Feet	5-10 Feet	5-10 Feet	10-15 Feet	5-7.5 Feet	5-10 Feet	10-15 Feet	5-10 Feet	10-15 Feet	5-8 Feet	5-10 Feet	10-13.5 Feet	10-15 Feet	5-9 Feet
Sample Depth Relative to October 1, 2016	10-15 Feet	5-10 Feet	5-10 Feet	10-15 Feet	5-7.5 Feet	5-10 Feet	10-15 Feet	5-10 Feet	10-15 Feet	5-8 Feet	5-10 Feet	10-13.5 Feet	10-15 Feet	5-9 Feet
NOTES:														
MADEP-EPH-04-1.1 (mg/Kg dry)														
C9-C18 ALIPHATICS		140		150	85	28	59	20	110	5.5	860	110	63	5.5
C19-C36 ALIPHATICS		**4700**		380	670	33	310	70	370	32	1200	500	330	18
C11-C22 AROMATICS		**3700**		850	650	90	530	220	570	67	**2400**	1000	560	48
ACENAPHTHENE		0.55		0.1	0.105	0.06	0.26	1.3	0.265	0.055	0.26	0.275	0.12	0.32
ACENAPHTHYLENE		0.55		0.1	0.105	0.06	0.26	0.055	0.265	0.055	0.26	0.275	0.12	0.055
ANTHRACENE		0.55		0.1	0.105	0.06	0.26	2.5	0.265	0.055	0.26	0.275	0.28	0.32
BENZO(A)ANTHRACENE		0.55		0.1	0.105	0.06	0.26	6	0.265	0.14	0.26	0.275	0.53	1.2
BENZO(A)PYRENE		0.55		0.1	0.105	0.06	0.26	**5.1**	0.265	0.12	0.26	0.275	0.64	1.3
BENZO(B)FLUORANTHENE		0.55		0.1	0.105	0.15	0.26	7	0.265	0.23	0.26	0.275	0.85	1.6
BENZO(G,H,I)PERYLENE		0.55		0.1	0.105	0.06	0.26	2.7	0.265	0.13	0.26	0.275	0.12	0.82
BENZO(K)FLUORANTHENE		0.55		0.1	0.105	0.06	0.26	2.6	0.265	0.055	0.26	0.275	0.12	0.57
CHRYSENE		0.55		0.1	0.105	0.25	0.26	6.7	0.265	0.28	0.26	0.275	0.74	1.3
DIBENZ(A,H)ANTHRACENE		0.55		0.1	0.105	0.06	0.26	**0.9**	0.265	0.055	0.26	0.275	0.12	0.19
FLUORANTHENE		0.55		0.1	0.105	0.15	0.26	*14*	0.265	0.3	1.8	0.275	1.8	2.8
FLUORENE		0.55		0.1	0.105	0.13	0.26	1.3	0.265	0.055	1.5	0.275	0.12	0.15
INDENO(1,2,3-CD)PYRENE		0.55		0.1	0.105	0.06	0.26	*3.3*	0.265	0.055	0.26	0.275	0.12	0.79
2-METHYLNAPHTHALENE		0.55		0.1	0.105	0.16	0.26	**0.99**	0.265	0.055	0.26	0.275	0.12	0.055
NAPHTHALENE		0.55		0.1	0.105	0.31	0.26	0.44	0.265	0.055	0.26	0.275	0.12	0.18
PHENANTHRENE		0.55		0.1	0.63	0.49	0.26	**11**	0.265	0.37	3.3	0.275	0.41	1.9
PYRENE		0.55		0.1	0.105	0.18	0.26	13	0.265	0.37	0.26	0.275	1.7	2.7
MADEP-VPH-04-1.1 (mg/Kg dry)														
BENZENE														
TOLUENE														

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATIONS													
	B-14A (10-15)	B-15 (5-10)	B-16 (5-10)	B-16 (10-15)	B-17 (5-7.5)	B-18 (5-10)	B-18 (10-15)	B-19 (5-10)	B-19 (10-15)	B-20 (5-8)	B-21 (5-10)	B-21 (10-13.5)	B-22 (10-15)	B-23 (5-9)
SW-846 6010C/D (mg/Kg dry) Metals Digestion														
BARIUM														
BERYLLIUM														
CHROMIUM (as +3)														
LEAD														
NICKEL														
VANADIUM														
ZINC														
SW-846 8082A (mg/Kg dry)														
TOTAL PCBs		0.30				0.06	0.05	**2.1**	0.055		0.75	0.055		
SW-846 8081B (mg/Kg dry)														
CHLORDANE														
4,4'-DDE														
4,4'-DDT														
DIELDRIN														
NOTES:														
1. ND = Not detected above the lab reporting														
limits shown in parenthesis.														
2. When calculating exposure point														
concentration, if no compound detected, one-														
half the lab reporting was used instead of zero.														

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATIONS			Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	B-26 (10-13)	B-27 (5-10)	B-28 (10-15)	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
Sampling Date	9/16/2016	9/16/2016	9/16/2016	Analyzed	Detected	> S-2	Concentration	Derive	Concentration	(Population)	Confidence	Confidence	Concentration
Sample Depth Relative to Original Grade on March 2016	13-16 Feet	8-13 Feet	13-18 Feet		> S-2 Standard	Standard		EPC for S-2 Soils			Interval	Limit on the Mean	
Sample Depth During Investigative Event	10-13 Feet	5-10 Feet	10-15 Feet										
Sample Depth Relative to October 1, 2016	10-13 Feet	5-10 Feet	10-15 Feet										
NOTES:													
MADEP-EPH-04-1.1 (mg/Kg dry)													
C9-C18 ALIPHATICS				19	0	0	8300	Mean	609				609
C19-C36 ALIPHATICS				19	0	0	11000	Mean	1189				1189
C11-C22 AROMATICS				19	0	0	15000	Mean	1568				1568
ACENAPHTHENE				19	0	0	1.3	Mean	0.30				0.30
ACENAPHTHYLENE				19	0	0	1.2	Mean	0.22				0.22
ANTHRACENE				19	0	0	11	Mean	0.96				1.0
BENZO(A)ANTHRACENE				19	0	0	6	Mean	0.70				0.7
BENZO(A)PYRENE				19	0	0	5.1	Mean	0.67				0.7
BENZO(B)FLUORANTHENE				19	0	0	7	Mean	0.83				0.8
BENZO(G,H,I)PERYLENE				19	0	0	2.7	Mean	0.46				0.5
BENZO(K)FLUORANTHENE				19	0	0	2.6	Mean	0.41				0.4
CHRYSENE				19	0	0	6.7	Mean	0.79				0.8
DIBENZ(A,H)ANTHRACENE				19	0	0	1.2	Mean	0.27				0.27
FLUORANTHENE				19	0	0	22	Mean	2.8				2.8
FLUORENE				19	0	0	29	Mean	2.0				1.97
INDENO(1,2,3-CD)PYRENE				19	0	0	3.3	Mean	0.48				0.5
2-METHYLNAPHTHALENE				19	0	0	65	Mean	3.9				3.94
NAPHTHALENE				19	0	0	27	Mean	1.8				1.79
PHENANTHRENE				19	0	0	35	Mean	3.3				3.3
PYRENE				19	0	0	13	Mean	2.0				2.0
MADEP-VPH-04-1.1 (mg/Kg dry)													
BENZENE				2	0	0	0.10	Mean	0.079				0.079
TOLUENE				2	0	0	0.60	Mean	0.46				0.46

Table N-4
Identification of Method to Derive Exposure Point Concentration and Calculation of Exposure Point Concentration: Original 6-15 Foot Interval
(December 2016)

Parameter	SAMPLING LOCATIONS			Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	B-26 (10-13)	B-27 (5-10)	B-28 (10-15)	Number	Number	%	Maximum	Method to	Mean	Standard Deviation	95th Percentile	Upper 95th Percentile	Exposure Point
SW-846 6010C/D (mg/Kg dry) Metals Digestion													
BARIUM				2	0	0	34	Mean	31				31
BERYLLIUM				2	0	0	0.145	Mean	0.14				0.14
CHROMIUM (as +3)				2	0	0	11	Mean	11				11
LEAD				2	0	0	100	Mean	71				71
NICKEL				2	0	0	11	Mean	10				10
VANADIUM				8	1	12.5	870	Mean	172				172
ZINC				2	0	0	43	Mean	40				40
SW-846 8082A (mg/Kg dry)													
TOTAL PCBs				17	1	5.9	6.2	95th% UCL on Mean	0.626	1.66	0.271	0.896	0.90
SW-846 8081B (mg/Kg dry)													
CHLORDANE				2	0	0	None Detected						
4,4'-DDE				2	0	0	None Detected						
4,4'-DDT				2	0	0	None Detected						
DIELDRIN				2	0	0	None Detected						
NOTES:													
1. ND = Not detected above the lab reporting													
limits shown in parenthesis.													
2. When calculating exposure point													
concentration, if no compound detected, one-													
half the lab reporting was used instead of zero.													

Table N-5
Identification of Method to Derive Soil Exposure Point Concentrations and Derivation of Soil Exposure Point Concentrations: Fuel Oil Vault Sands (SP-3)
(April 2016)

Parameter	MCP - Method 2 Direct Contact Standards			Upper Concentration Limit				
	S-1	S-2	S-3	UCL	SP-3	FO-1-TP (0-1')	FO-1-TP (1-2')	FO-1-TP (2-3')
Sampling Date					3/29/2016	3/9/2016	3/9/2016	3/9/2016
Sample Depth					Stockpile / Sands in vault	0-1 Feet (below grade /	1-2 Feet (below grade /	2-3 Feet (below grade /
MADEP-EPH-04-1.1 (mg/Kg dry)								
ACENAPHTHENE	1000	3000	5000	10000	0.70			
ACENAPHTHYLENE	1000	3000	5000	10000	0.090			
ANTHRACENE	1000	3000	5000	10000	1.5			
BENZO(A)ANTHRACENE	7	40	300	3000	3.0			
BENZO(A)PYRENE	2	7	30	300	2.6			
BENZO(B)FLUORANTHENE	7	40	300	3000	3.5			
BENZO(G,H,I)PERYLENE	1000	3000	5000	10000	1.4			
BENZO(K)FLUORANTHENE	70	400	3000	10000	1.4			
CHRYSENE	70	400	3000	10000	2.8			
DIBENZ(A,H)ANTHRACENE	0.7	4	30	300	0.59			
FLUORANTHENE	1000	3000	5000	10000	7.0			
FLUORENE	1000	3000	5000	10000	0.93			
INDENO(1,2,3-CD)PYRENE	7	40	300	3000	1.4			
2-METHYLNAPHTHALENE	300	500	500	5000	0.29			
NAPHTHALENE	500	1000	3000	10000	0.59			
PHENANTHRENE	500	1000	3000	10000	5.9			
PYRENE	1000	3000	5000	10000	5.0			
SW-846 6010C/D (mg/Kg dry) Metals Digestion								
BARIUM	1000	3000	5000	10000	50	140	95	130
BERYLLIUM	90	200	200	2000	0.73	0.68	0.39	1.9
CHROMIUM (as +3)	1000	3000	5000	10000	30	36	31	37
LEAD	200	600	600	6000	25	340	1100	220
NICKEL	600	1000	1000	10000	18	32	22	29
THALLIUM	8	8	8	800	9.8	1.4	1.45	1.45
VANADIUM	400	700	700	7000	33	160	96	140
ZINC	1000	3000	5000	10000	43	250	160	190
SW-846 8082A (mg/Kg dry)								
TOTAL PCBs	1	4	4	100	2.6	13	12	7.8
SW-846 8081B (mg/Kg dry)								
4,4'-DDT	6	30	60	600	0.019	0.15	0.13	0.13
DIELDRIN	0.08	0.5	3	30	0.0021	0.16	0.19	0.16
NOTES:								
When no analyte detected, one-half reported								
detection limit used to calculate exposure								
point concentration.								

Table N-5
Identification of Method to Derive Soil Exposure Point Concentrations and Derivation of Soil Exposure Point Concentrations: Fuel Oil Vault Sands (SP-3)
(April 2016)

Parameter	Evaluation: S-2 Soils					Derivation of Exposure Point Concentration				
	Number	Number	%	Maximum	Method to	Mean	Standard	95th	Upper 95th	Exposure
Sampling Date	Analyzed	Detected	> S-2	Concentration	Derive	Concentration	Deviation (Population)	Percentile Confidence	Confidence	Point
Sample Depth		> S-2 Standard	Standard		EPC for S-2 Soils			Interval	Limit on the Mean	Concentration
MADEP-EPH-04-1.1 (mg/Kg dry)										
ACENAPHTHENE	1	0		0.70	Conc. Det'd					0.70
ACENAPHTHYLENE	1	0		0.090	Conc. Det'd					0.090
ANTHRACENE	1	0		1.5	Conc. Det'd					1.5
BENZO(A)ANTHRACENE	1	0		3.0	Conc. Det'd					3.0
BENZO(A)PYRENE	1	0		2.6	Conc. Det'd					2.6
BENZO(B)FLUORANTHENE	1	0		3.5	Conc. Det'd					3.5
BENZO(G,H,I)PERYLENE	1	0		1.4	Conc. Det'd					1.4
BENZO(K)FLUORANTHENE	1	0		1.4	Conc. Det'd					1.4
CHRYSENE	1	0		2.8	Conc. Det'd					2.8
DIBENZ(A,H)ANTHRACENE	1	0		0.59	Conc. Det'd					0.59
FLUORANTHENE	1	0		7.0	Conc. Det'd					7.0
FLUORENE	1	0		0.93	Conc. Det'd					0.93
INDENO(1,2,3-CD)PYRENE	1	0		1.4	Conc. Det'd					1.4
2-METHYLNAPHTHALENE	1	0		0.29	Conc. Det'd					0.29
NAPHTHALENE	1	0		0.59	Conc. Det'd					0.59
PHENANTHRENE	1	0		5.9	Conc. Det'd					5.9
PYRENE	1	0		5.0	Conc. Det'd					5.0
SW-846 6010C/D (mg/Kg dry) Metals Digestion										
BARIUM	4	0		140	Mean	104				104
BERYLLIUM	4	0		1.9	Mean	0.93				0.93
CHROMIUM (as +3)	4	0		37	Mean	34				34
LEAD	4	1	25.0	1100	Mean	421				421
NICKEL	4	0		32	Mean	25				25
THALLIUM	4	0		9.8	Mean	3.5				3.5
VANADIUM	4	0		160	Mean	107				107
ZINC	4	0		250	Mean	161				161
SW-846 8082A (mg/Kg dry)										
TOTAL PCBs	4	3	75.0	13	95th % UCL	8.9	4.10	4.02	12.87	13
SW-846 8081B (mg/Kg dry)										
4,4'-DDT	4	0		0.15	Mean	0.11				0.11
DIELDRIN	4	0		0.19	Mean	0.13				0.13
NOTES:										
When no analyte detected, one-half reported										
detection limit used to calculate exposure										
point concentration.										

Table N-6
Summary of Dioxin-Like PCB Congener Data for Courtyard Soil Samples
(April 2016)

Analyte	Units	B-5 (0-1')	B-7 (1-3')	B-9 (0-1')	B-11 (1-3)
Date Sampled		14-Mar-16	14-Mar-16	14-Mar-16	14-Mar-16
Sample Depth		0-1 Feet	1-3 Feet	0-1 Feet	1-3 Feet
Cl4-BZ#81	µg/kg	<3.8	<3.8	<3.9	<0.75
Cl4-BZ#77	µg/kg	<3.8	<3.8	<3.9	<0.75
Cl5-BZ#123/#107	µg/kg	14	32	100	<1.5
Cl5-BZ#118	µg/kg	210	450	1600	2.4
Cl5-BZ#114	µg/kg	<3.8	8.8	19	<0.75
Cl5-BZ#105	µg/kg	59	150	440	0.79
Cl5-BZ#126	µg/kg	<3.8	<3.8	<3.9	<0.75
Cl6-BZ#167	µg/kg	13	22	69	<0.75
Cl6-BZ#156	µg/kg	28	60	<3.9	<0.75
Cl6-BZ#157	µg/kg	8.8	17	59	<0.75
Cl6-BZ#169	µg/kg	<3.8	<3.8	<3.9	<0.75
Cl7-BZ#189	µg/kg	<3.8	<3.8	8.8	<0.75

C14-BZ#77 = 3,3',4,4'-tetrachlorobiphenyl (TCB)
C14-BZ#81 = 3,4,4',5-TCB
C15-BZ#105 = 2,3,3',4,4'-pentachlorobiphenyl (PeCB)
C15-BZ#114 = 2,3,4,4',5-PeCB
C15-BZ#118 = 2,3',4,4',5-PeCB
C15-BZ#123 = 2',3,4,4',5-PeCB
C15-BZ#126 = 3,3',4,4',5-PeCB
C16-BZ#156 = 2,3,3',4,4',5-hexachlorobiphenyl (HxCB)
C16-BZ#157 = 2,3,3',4,4',5'-HxCB
C16-BZ#167 = 2,3',4,4',5,5'-HxCB
C16-BZ#169 = 3,3',4,4',5,5'-HxCB
C17-BZ#189 = 2,3,3',4,4',5,5'-heptachlorobiphenyl (HpCB)

List of Dioxin-Like Congeners obtained from Table 2 of USEPA's Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin & Dioxin-Like Compounds, (EPA/100/R 10/005/ December 2010)

Those Dioxin-Like Congeners shown in **bold text** were not detected in any sample, and therefore, were eliminated from further evaluation in Tables 16 and 17.

Table N-7
Calculation of TCDD Toxic Equivalence for Soil Analytical Data: Dioxin-Like PCB Congeners
(April 2016)

Analyte		Units	B-5 (0-1')	B-7 (1-3')	B-9 (0-1')	B-11 (1-3)
Date Sampled	TEF		14-Mar-16	14-Mar-16	14-Mar-16	14-Mar-16
Sample Depth			0-1 Feet	1-3 Feet	0-1 Feet	1-3 Feet
Cl5-BZ#123/#107	0.00003	µg/kg	14	32	100	0.75
Cl5-BZ#118	0.00003	µg/kg	210	450	1600	2.4
Cl5-BZ#114	0.00003	µg/kg	1.9	8.8	19	0.375
Cl5-BZ#105	0.00003	µg/kg	59	150	440	0.79
Cl6-BZ#167	0.00003	µg/kg	13	22	69	0.375
Cl6-BZ#156	0.00003	µg/kg	28	60	1.95	0.375
Cl6-BZ#157	0.00003	µg/kg	8.8	17	59	0.375
Cl7-BZ#189	0.00003	µg/kg	1.9	1.9	8.8	0.375
TEQ			1.01E-02	2.23E-02	6.89E-02	1.74E-04
Total Dioxin-Like Congeners		µg/kg	336.6	741.7	2297.75	5.815

C15-BZ#105 = 2,3,3',4,4'-pentachlorobiphenyl (PeCB)
C15-BZ#114 = 2,3,4,4',5-PeCB
C15-BZ#118 = 2,3',4,4',5-PeCB
C15-BZ#123 = 2',3,4,4',5-PeCB
C16-BZ#156 = 2,3,3',4,4',5-hexachlorobiphenyl (HxCB)
C16-BZ#157 = 2,3,3',4,4',5'-HxCB
C16-BZ#167 = 2,3',4,4',5,5'-HxCB
C17-BZ#189 = 2,3,3',4,4',5,5'-heptachlorobiphenyl (HpCB)

TEFs for Dioxin-Like Congeners obtained from Table 2 of USEPA's Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin & Dioxin-Like Compounds, (EPA/100/R 10/005/ December 2010)

TCDD = 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin
TEF = TCDD Toxicity Equivalence Factor
TEQ = TCDD Toxic Equivalence (summation of products of congener concentration and TEF, for each congener *i*)

If no congener detected for a given sample, one-half the reported detection limit (<#) was used as a surrogate value.

Sample B-11 (1-3) contains a low level of PCB congeners and was not used for further analysis.

Table N-8

Comparison of Total Dioxin-Like PCB Congeners to TCDD Equivalence and Total PCB Congeners

(April 2016)

Analyte	**Units**	**B-5 (0-1')**	**B-7 (1-3')**	**B-9 (0-1')**
Date Sampled		14-Mar-16	14-Mar-16	14-Mar-16
Sample Depth		0-1 Feet	1-3 Feet	0-1 Feet
Total PCB-Congeners (Table 1)	mg/kg	3.3853	6.7551	22.2447
Total Dioxin-Like Congeners (Table N-8)	mg/kg	0.3366	0.7417	2.29775
Dioxin-Like Congeners, as a percent of				
Total PCB-Congeners	%	9.9	11.0	10.3
TCDD Toxic Equivalence (Table N-8)	mg/kg	1.01E-05	2.23E-05	6.89E-05
TCDD Toxic Equivalence as proportion		2.98E-06	3.30E-06	3.10E-06
of Total PCB-congeners				

Reference: USEPA's Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin & Dioxin-Like Compounds, (EPA/100/R 10/005/ December 2010)

TCDD = 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin

TEF = TCDD Toxicity Equivalence Factor

TEQ = TCDD Toxic Equivalence (summation of products of congener concentration and TEF, for each congener *i*)

Table N-9

Calculation of Dioxin-Like PCB Congener Exposure Point Concentrations, as TCDD Equivalence

(December 2016)

Exposure Point	Units	PCB Exposure Point Concentration	Fraction as TCDD-Like PCBs	TCDD-Like PCB Concentration	TEF for all dioxin-like congeners*	TCDD-Like PCB Exposure Point Concentration
			unitless		unitless	
0-3 Foot Interval	mg/kg	14	0.11	1.54	3.00E-05	4.62E-05
3-6 Foot Interval	mg/kg	4.1	0.11	0.451	3.00E-05	1.35E-05
6-11 Foot Interval	mg/kg	0.90	0.11	0.099	3.00E-05	2.97E-06
Fuel Oil Vault Sands (SP-3)	mg/kg	13	0.11	1.43	3.00E-05	4.29E-05
PCB Cleanup Standard	mg/kg	10	0.11	1.1	3.00E-05	3.30E-05

Reference: USEPA's Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin & Dioxin-Like Compounds, (EPA/100/R 10/005/ December 2010)

* All detected TCDD-like PCB congeners had the same TEF value of 0.00003 (3.00E-05), which simplified the calculation of EPCs for dioxin-like PCBs.

EPC = Exposure Point Concentration

TCDD = 2,3,7,8-Tetrachlorodibenzo-*p* -dioxin

TEF = TCDD Toxicity Equivalence Factor

TEQ = TCDD Toxic Equivalence (summation of products of congener concentration and TEF, for each congener *i*)

Table N-10
Comparison of Risk Estimates to MCP Risk Limits
(December 2016)

Receptor	Exposure Point	Soil Interval (feet)	ELCR	Cancer Risk Limit	Significant Risk of Harm?	HI	Non-Cancer Risk Limit	Significant Risk of Harm?
Resident	Courtyard	0 - 3	7.8E-06	1.E-05	No	2.4	1	**Yes**
	Courtyard	3 - 6	1.3E-06	1.E-05	No	0.38	1	No
	Courtyard	6 - 15	3.6E-07	1.E-05	No	0.18	1	No
	Fuel Oil Vault Sands	Stockpile SP-3	3.3E-06	1.E-05	No	1.2	1	**Yes**
	Courtyard	PCB Cleanup Standard*	2.4E-06	1.E-05	No	0.69	1	No

ASSUMPTIONS:
NO SINGLE FAMILY RESIDENCE. NO GARDENING OF EDIBLE PRODUCE.
EXPOSURE TO SOILS OCCURS ONLY DURING A SINGLE SIX-MONTH CONSTRUCTION PROJECT, AFTER WHICH TIME
THE SOILS ARE RETURNED TO EXCAVATION OR ARE TRANSPORTED OFF-SITE.
ASSUME CONTROLS ARE USED TO LIMIT RESIDENTIAL EXPOSURE TO SOILS DURING CONSTRUCTION PROJECT.
PROTECTIVE COVER MUST REMAIN OVER SOILS EXCEPT DURING CONSTRUCTION OR UTILITY PROJECT, AFTER WHICH TIME
THE PROTECTIVE COVER MUST BE RE-INSTALLED.
* PCB CLEANUP STANDARD IS SET AS AN EXPOSURE POINT CONCENTRATION OF 10 MG/KG; THE EXPOSURE POINT CONCENTRATION
IS THE 95TH% UPPER CONFIDENCE LIMIT ON THE MEAN.

Table N-11

Comparison of MassDEP and USEPA Exposure Factors

Receptor / Medium	Exposure Factor	Unit	USEPA	Notes	MassDEP *	Notes	Interpretation
Resident, aged 1-<2 years							
Soils	Surface Area (SA)	cm^2/d	2800	1a	1670	1b	MADEP: SA/BW would result in 15.6% lower risk estimate for dermal contact than if USEPA assumption used.
Soils	Mass of soil adhered per unit exposed skin (AF)	mg/cm^2	0.2	2b	0.35	2b	MADEP: 17.5% higher risk estimate for dermal contact than if used USEPA's AF.
Soils	Ingestion Rate (IR)	mg/d	100	3a	100	3b	No effect re. IR alone. MADEP: IR/BW would result in 40% higher risk estimate for incidental ingestion than if USEPA assumption used.
Soils	Body Weight (BW)	kg	15	4a	10.7	4b	See SA and IR
Soils	Exposure Frequency (EF)	d/yr	350	5a	52	5b	MADEP: 85% lower risk estimate than if used USEPA's EF default; however, this receptor assumed to be exposed to soils only during 6-month construction period and access to soils limited by implementation of Soil Management Plan, otherwise soils are covered with cap.
Dusts	Exposure Frequency (EF)	d/yr	365	6a	182	6b	MADEP: Assume EF shortened via maintenance of cap and Notice of Activity and Use Limitation; otherwise, cancer risk estimates would be higher.
Both	Exposure Period (EP)	year	30	7a	1	7b	MADEP: Assume EP shortened via maintenance of cap and Notice of Activity and Use Limitation; otherwise, cancer risk estimates would be higher.
Both	Averaging Period (AP) (Non-cancer)	year	30	8	1	8	No effect, because EP = AP
Both	Averaging Period (AP) (Cancer)	year	70	9a	70	9b	No effect.
Both	Exposure Duration (ED)	d/event	1	10a	1	10b	No effect.

Table N-11

Comparison of MassDEP and USEPA Exposure Factors

Notes for Resident, aged 1 to 2 years old:

* Exposure factors used by GEC in Method 3 Human Health Risk Characterization:

1a. Page 3-11 of Risk Assessment Guidance for Superfund (RAGS): Volume I Part E. Assumed exposure to head, forearms, hands, lower legs and feet; 50th percentile value for children aged <1 to <6 of both sexes. For children younger than 2, aged two values were used in this calculation.

1b. Face, hands, forearms, lower legs and feet for age 1-2 year old, default value used by MADEP in their risk assessments. From Table B-2 of *Guidance for Disposal Site Risk Characterization* , MADEP, 1995. 50th percentile of face (1/3 head), forearms, hands, lower legs and feet for females.

2a. Page 3-14 of Risk Assessment Guidance for Superfund (RAGS): Volume I Part E. 95th percentile weighted AF for children playing at a daycare

2b. Value used by MADEP for children up to age 8 years, for deriving Method 1 S-1 standards and in Risk Assessment Short Forms. Value was derived according to procedure provided in MADEP's Technical Update: Weighted Skin-Soil Adherence Factors, April 2002.

3a. Table 5-1 in Exposure Factors Handbook. Value provided is general central population tendency for a child aged 1 to <6 years old. General population upper tendency for a 3 to <6 year old child is 200 mg/kg. (Values provide for both dust and soil ingestion)

3b. Soil ingestion rate used by MADEP for children up to 8 years, in Risk Assessment Short Form. From, MADEP (2002), Technical Update: Calculation of an Enhanced Soil Ingestion Rate.

4a. Page 3-19 of Risk Assessment Guidance for Superfund (RAGS): Volume I Part E. Average body weight, ages 1 to 6 years.

4b. Body weight for age 1-2 year old female, default value used by MADEP in Risk Assessment Short Form.

5a. Page 3-20 of RAGS: Volume I Part E. RME for Resident is 350 days per year

5b. 2 days per week during a single six-month construction project

6a. Presume daily exposure to dusts by resident

6b. 7 days per week during a single six-month construction project

7a. Page 3-20 of RAGS: Volume I Part E. RME for Resident is 30 years.

7b. Exposure period is during year when construction project is occurring, otherwise cap maintained per Notice of Activity and Use Limitation.

8. Non-cancer averaging period is the same as the exposure period.

9a. Value used by USEPA for cancer averaging period

9b. Value used by MADEP for cancer averaging period

10a. Page 3-20 of RAGS: Volume I Part E. RME for event frequency is 1 day per event.

10b. Assume that exposure duration for both dust inhalation and soil contact is 1 day (24-hours) per event

Table N-12
Comparison of USEPA and MassDEP Absorption Factors

Contaminant of Concern	Pathway	USEPA	Notes	MADEP *	Notes	Interpretation
Barium	Dermal Contact	none available	1a	0.05	2	MADEP: Higher risk because dermal exposure to barium in soils is not excluded from quantitative risk
Chromium (III)	Dermal Contact	none available	1a	0.04	2	MADEP: Higher risk because dermal exposure to chromium in soils is not excluded from quantitative risk assessment
Lead	Dermal Contact	none available	1a	0.006	2	MADEP: Higher risk because dermal exposure to lead in soils is not excluded from quantitative risk assessment
Mercury	Dermal Contact	none available	1a	0.05	2	MADEP: Higher risk because dermal exposure to mercury in soils is not excluded from quantitative risk assessment
Nickel	Dermal Contact	none available	1a	0.35	2	MADEP: Higher risk because dermal exposure to nickel in soils is not excluded from quantitative risk assessment
Total PCBs (PCB 1248 and PCB 1254)	Dermal Contact	0.14	1b	0.16	2	MADEP: 14.3% higher risk estimate for dermal absorption for PCBs than if used USEPA's value.
Vanadium	Dermal Contact	none available	1a	0.03	2	MADEP: Higher risk because dermal exposure to vanadium in soils is not excluded from quantitative risk assessment
C19-C36 Aliphatic Hydrocarbons	Dermal Contact	0.1	1c	0.1	2	No effect.
C11-C22 Aromatic Hydrocarbons	Dermal Contact	0.1	1c	0.18	2	MADEP: 80% higher risk estimate for dermal absorption for C11-C22 aromatic hydrocarbons than if used USEPA's default value for

Notes for Soil Dermal Absorption Factors:

1a. Section 3.2.2.4 and Exhibit 3-4 of RAGS: Volume I Part E. No soil dermal absorption factors available for most contaminants. For these contaminants, USEPA recommends evaluating risks qualitatively in the uncertainty section of the risk assessment, rather than quantitatively.

1b. Exhibit 3-4 of Risk Assessment Guidance for Superfund (RAGS): Volume I Part E. Provides available soil dermal absorption factors, of which only one contaminant of concern (Aroclors 1254/1242) has a soil dermal absorption factor.

1c. Exhibit 3-4 of RAGS: Volume I Part E. Default value for semi-volatile organic compounds.

2. MADEP values used to derive Method 1 S-1, S-2 and S-3 soil standards and in the Risk Assessment Short Forms.

Table N-12
Comparison of USEPA and MassDEP Absorption Factors

Contaminant of Concern	Pathway	USEPA	Notes	MADEP *	Notes	Interpretation
Barium	Ingestion	0.07	1b	1	2	MADEP: 13.3% higher risk estimate for gi absorption of barium than if used USEPA's value.
Chromium (III)	Ingestion	0.013	1b	1	2	MADEP: 75.9% higher risk estimate for gi absorption of chromium than if used USEPA's value.
Lead	Ingestion	not provided	1a	0.5	2	
Mercury	Ingestion	0.07	1b	1	2	MADEP: 13.3% higher risk estimate for gi absorption of mercury than if used USEPA's value.
Nickel	Ingestion	0.04	1b	1	2	MADEP: 24% higher risk estimate for gi absorption of nickel than if used USEPA's value.
Total PCBs (PCB 1242 and PCB 1254)	Ingestion	0.80 to 1.0	1c	0.85	2	MADEP: Little effect on risk estimate. MADEP's oral absorption factor is within the range provided by USEPA.
Vanadium	Ingestion	0.026	1b	1	2	MADEP: 37.5% higher risk estimate for gi absorption of vanadium than if used USEPA's value.
C19-C36 Aliphatic Hydrocarbons	Ingestion	not provided	1a	1	2	
C11-C22 Aromatic Hydrocarbons	Ingestion	not provided	1a	0.36	2	

Notes for Soil Ingestion Absorption Factors:

1a. Exhibit 4-1 of Risk Assessment Guidance for Superfund (RAGS): Volume I Part E. No soil oral absorption factors provided.

1b. Exhibit 4-1 of RAGS: Volume I Part E. Soil oral (GI) absorption factors based on studies where delivery vehicle was water, diet or (for vanadium) gavage (vehicle not specified). No soil GI absorption factors are provided.

1c. Exhibit 4-1 of RAGS: Volume I Part E. Soil oral (GI) absorption factor based on studies where delivery vehicles were squalene, "emulsion" and corn oil. No soil GI absorption factors are provided.

2. MADEP values used to derive Method 1 S-1, S-2 and S-3 soil standards and in the Risk Assessment Short Forms.

Table 1.1
Soil Exposure Point Concentrations and Soil Concentrations used to Derive Dust Exposure Point Concentrations

Chemical Name	CAS Number	Courtyard 0-3 Foot Interval	Courtyard 3-6 Foot Interval	Courtyard 6-15 Foot Interval	Stockpiled Fuel Oil Vault Sands SP-3	Derivation of PCB Cleanup Standard
acenaphthene	83-32-9	8.5E-01	5.2E-01	3.0E-01	7.0E-01	5.2E-01
acenaphthylene	208-96-8	2.2E-01	1.7E-01	2.2E-01	9.0E-02	1.7E-01
anthracene	120-12-7	1.9E+00	1.0E+00	9.6E-01	1.5E+00	1.0E+00
barium	7440-39-3	9.9E+01	4.80E+01	3.10E+01	1.04E+02	4.80E+01
benzene	71-43-2		4.5E-02	7.9E-02		4.5E-02
benzo(a)anthracene	56-55-3	4.2E+00	2.1E+00	7.0E-01	3.0E+00	2.1E+00
benzo(a)pyrene	50-32-8	3.8E+00	1.9E+00	6.7E-01	2.6E+00	1.9E+00
benzo(b)fluoranthene	205-99-2	4.9E+00	2.6E+00	8.3E-01	3.5E+00	2.6E+00
benzo(k)fluoranthene	207-08-9	1.8E+00	1.0E+00	4.1E-01	1.4E+00	1.0E+00
benzo(ghi)perylene	191-24-2	2.1E+00	1.1E+00	4.6E-01	1.4E+00	1.1E+00
beryllium	7440-41-7	4.5E+00	6.1E+00	1.4E-01	9.3E-01	6.1E+00
chlordane	57-74-9		1.1E-01			1.1E-01
chromium (III)	16065-83-1	3.5E+01	1.8E+01	1.1E+01	3.4E+01	1.8E+01
chrysene	218-01-9	4.6E+00	2.2E+00	7.9E-01	2.8E+00	2.2E+00
dibenzo(a,h)anthracene	53-70-3	6.4E-01	3.8E-01	2.7E-01	5.9E-01	3.8E-01
DDE	72-55-9	4.7E-02				
DDT	50-29-3	9.0E-02	3.2E-02		1.1E-01	3.2E-02
dieldrin	60-57-1	9.3E-02	2.8E-02		1.7E-01	2.8E-02
dioxin (TCDD equivalents)	1746-01-6	4.6E-05	1.4E-05	3.0E-06	4.3E-05	3.3E-05
fluoranthene	206-44-0	9.7E+00	5.3E+00	2.8E+00	7.0E+00	5.3E+00
fluorene	86-73-7	9.0E-01	5.5E-01	2.0E+00	9.3E-01	5.5E-01
indeno(123-cd)pyrene	193-39-5	2.4E+00	1.2E+00	4.8E-01	1.4E+00	1.2E+00
lead	7439-92-1	3.90E+02	9.50E+01	7.10E+01	4.21E+02	9.50E+01
2-methylnaphthalene	91-57-6	3.2E-01	8.9E-01	3.9E+00	2.9E-01	8.9E-01
naphthalene	91-20-3	7.3E-01	2.7E-01	1.8E+00	5.9E-01	2.7E-01
nickel (soluble salts)	7440-02-0	3.1E+01	2.4E+01	1.0E+01	2.5E+01	2.4E+01
phenanthrene	85-01-8	7.7E+00	4.6E+00	3.3E+00	5.9E+00	4.6E+00
polychlorinated biphenyls, as PCB-1254	1336-36-3	4.1E+01	4.1E+00	9.0E-01	1.3E+01	1.0E+01
pyrene	129-00-0	9.2E+00	4.6E+00	2.0E+00	5.0E+00	4.6E+00
thallium	7440-28-0				3.5E+00	
toluene	108-88-3		1.5E-01	4.6E-01		1.5E-01
vanadium	7440-62-2	3.5E+02	1.5E+02	1.7E+02	1.1E+02	1.5E+02
zinc	7440-66-6	1.7E+02	8.6E+01	4.0E+01	1.6E+02	8.6E+01
C9-C18 Aliphatics	N/A	4.40E+01	1.62E+02	6.09E+02		1.62E+02
C19-C36 Aliphatics	N/A	1.79E+02	2.63E+02	1.19E+03		2.63E+02
C11-C22 Aromatics	N/A	2.97E+02	5.57E+02	1.57E+03		5.57E+02

unit, milligram per kilogram (mg/kg), ppm
Abbreviations:

Table 1.2
Exposure Point Concentrations for Dust

Chemical Name	CAS Number	Courtyard 0-3 Foot Interval	Courtyard 3-6 Foot Interval	Courtyard 6-15 Foot Interval	Stockpiled Fuel Oil Vault Sands SP-3	Derivation of PCB Cleanup Standard	0.00	0.00
acenaphthene	83-32-9	5.10E-05	3.12E-05	1.80E-05	4.20E-05	3.12E-05		
acenaphthylene	208-96-8	1.32E-05	1.02E-05	1.32E-05	5.40E-06	1.02E-05		
anthracene	120-12-7	1.14E-04	6.00E-05	5.76E-05	9.00E-05	6.00E-05		
barium	7440-39-3	5.94E-03	2.88E-03	1.86E-03	6.24E-03	2.88E-03		
benzene	71-43-2		2.70E-06	4.74E-06		2.70E-06		
benzo(a)anthracene	56-55-3	2.52E-04	1.26E-04	4.20E-05	1.80E-04	1.26E-04		
benzo(a)pyrene	50-32-8	2.28E-04	1.14E-04	4.02E-05	1.56E-04	1.14E-04		
benzo(b)fluoranthene	205-99-2	2.94E-04	1.56E-04	4.98E-05	2.10E-04	1.56E-04		
benzo(k)fluoranthene	207-08-9	1.08E-04	6.00E-05	2.46E-05	8.40E-05	6.00E-05		
benzo(ghi)perylene	191-24-2	1.26E-04	6.60E-05	2.76E-05	8.40E-05	6.60E-05		
beryllium	7440-41-7	2.70E-04	3.66E-04	8.40E-06	5.58E-05	3.66E-04		
chlordane	57-74-9		6.60E-06			6.60E-06		
chromium (III)	16065-83-1	2.10E-03	1.08E-03	6.60E-04	2.04E-03	1.08E-03		
chrysene	218-01-9	2.76E-04	1.32E-04	4.74E-05	1.68E-04	1.32E-04		
dibenzo(a,h)anthracene	53-70-3	3.84E-05	2.28E-05	1.62E-05	3.54E-05	2.28E-05		
DDE	72-55-9	2.82E-06						
DDT	50-29-3	5.40E-06	1.92E-06		6.60E-06	1.92E-06		
dieldrin	60-57-1	5.58E-06	1.68E-06		1.02E-05	1.68E-06		
dioxin (TCDD equivalents)	1746-01-6	2.77E-09	8.10E-10	1.78E-10	2.57E-09	1.98E-09		
fluoranthene	206-44-0	5.82E-04	3.18E-04	1.68E-04	4.20E-04	3.18E-04		
fluorene	86-73-7	5.40E-05	3.30E-05	1.20E-04	5.58E-05	3.30E-05		
indeno(123-cd)pyrene	193-39-5	1.44E-04	7.20E-05	2.88E-05	8.40E-05	7.20E-05		
lead	7439-92-1	2.34E-02	5.70E-03	4.26E-03	2.53E-02	5.70E-03		
2-methylnaphthalene	91-57-6	1.92E-05	5.34E-05	2.34E-04	1.74E-05	5.34E-05		
naphthalene	91-20-3	4.38E-05	1.62E-05	1.08E-04	3.54E-05	1.62E-05		
nickel (soluble salts)	7440-02-0	1.86E-03	1.44E-03	6.00E-04	1.50E-03	1.44E-03		
phenanthrene	85-01-8	4.62E-04	2.76E-04	1.98E-04	3.54E-04	2.76E-04		
polychlorinated biphenyls, as PCB-1254	1336-36-3	2.46E-03	2.46E-04	5.40E-05	7.80E-04	6.00E-04		
pyrene	129-00-0	5.52E-04	2.76E-04	1.20E-04	3.00E-04	2.76E-04		
thallium	7440-28-0				2.10E-04			
toluene	108-88-3		9.24E-06	2.76E-05		9.24E-06		
vanadium	7440-62-2	2.08E-02	8.70E-03	1.03E-02	6.42E-03	8.70E-03		
zinc	7440-66-6	1.00E-02	5.16E-03	2.40E-03	9.66E-03	5.16E-03		
C9-C18 Aliphatics	N/A	2.64E-03	9.72E-03	3.65E-02		9.72E-03		
C19-C36 Aliphatics	N/A	1.07E-02	1.58E-02	7.13E-02		1.58E-02		
C11-C22 Aromatics	N/A	1.78E-02	3.34E-02	9.41E-02		3.34E-02		

Formula: EPC-air = [OHM]-soil * PF * PM-10 * CF

where,
EPC-air = Exposure Point Concentration (ug/cu m)
[OHM]-soil = soil concentration (mg/kg)
PM-10 = respirable particulate concentration in air (60 ug/cu m)
PF = proportion of respirable particulate concentrations attributable to the site (1.0)
CF = conversion factor (1E-06 kg/ug)

Units: Soil EPC = mg/kg
Dust EPC = ug/cu m

Refer to Table 6.4 for Soil Concentrations used to derive Dust Exposure Point Concentrations

Table 2.1
Noncancer Dose-Response Values:
Oral Reference Dose

Chemical Name	CAS Number	Subchronic Oral RfD (mg/kg/day)	Uncertainty/ Modifying Factors	Source	Date Last Checked	Chronic Oral RfD (mg/kg/day)	Uncertainty/ Modifying Factors	Source	Date Last Checked
acenaphthene	83-32-9	2.0E-01		MADEP (6)		6.0E-02		MADEP (6)	
acenaphthylene	208-96-8	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
anthracene	120-12-7	1.0E+00		MADEP (6)		3.0E-01		MADEP (6)	
barium	7440-39-3	7.0E-02		MADEP (6)		2.0E-01		MADEP(6)	
benzene	71-43-2	1.0E-02		MADEP (6)		4.0E-03		MADEP (6)	
benzo(a)anthracene	56-55-3	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
benzo(a)pyrene	50-32-8	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
benzo(b)fluoranthene	205-99-2	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
benzo(k)fluoranthene	207-08-9	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
benzo(ghi)perylene	191-24-2	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
beryllium	7440-41-7	5.0E-03		MADEP (6)		2.0E-03		MADEP (6)	
cadmium	7440-43-9	5.0E-04		MADEP (6)		5.0E-04		MADEP (6)	
chlordane	57-74-9	5.0E-04		MADEP (6)		2.0E-03		MADEP (6)	
chromium (III)	16065-83-1	1.5E+00		MADEP (6)		1.5E+00		MADEP (6)	
chrysene	218-01-9	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
dibenzo(a,h)anthracene	53-70-3	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
DDE	72-55-9	5.0E-04		MADEP (6)		5.0E-04		MADEP (6)	
DDT	50-29-3	5.0E-04		MADEP (6)		5.0E-04		MADEP (6)	
dieldrin	60-57-1	5.0E-05		MADEP (6)		5.0E-05		MADEP (6)	
dioxin (TCDD equivalents)	1746-01-6	7.0E-10		MADEP (6)		7.0E-10		MADEP (6)	
fluoranthene	206-44-0	4.0E-01		MADEP (6)		4.0E-02		MADEP (6)	
fluorene	86-73-7	4.0E-01		MADEP (6)		4.0E-02		MADEP (6)	
indeno(123-cd)pyrene	193-39-5	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
lead	7439-92-1	7.5E-04		MADEP (6)		7.5E-04		MADEP (6)	
2-methylnaphthalene	91-57-6	4.0E-03		MADEP (6)		4.0E-03		MADEP (6)	
naphthalene	91-20-3	2.0E-01		MADEP (6)		2.0E-02		MADEP (6)	
nickel (soluble salts)	7440-02-0	2.0E-02		MADEP (6)		2.0E-02		MADEP (6)	
phenanthrene	85-01-8	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	
polychlorinated biphenyls, as PCB-1254	1336-36-3	5.0E-05		MADEP (6)		2.0E-05		MADEP (6)	
pyrene	129-00-0	3.0E-01		MADEP (6)		3.0E-05		MADEP (6)	
thallium	7440-28-0	8.0E-04		MADEP (6)		8.0E-05		MADEP (6)	
toluene	108-88-3	8.0E-01		MADEP (6)		8.0E-02		MADEP (6)	
vanadium	7440-62-2	9.0E-03		MADEP (6)		9.0E-03		MADEP (6)	
zinc	7440-66-6	3.0E-01		MADEP (6)		3.0E-01		MADEP (6)	
C9-C18 Aliphatics	N/A	1.0E+00		MADEP (6)		1.0E-01		MADEP (6)	
C19-C36 Aliphatics	N/A	6.0E+00		MADEP (6)		2.0E+00		MADEP (6)	
C11-C22 Aromatics	N/A	3.0E-01		MADEP (6)		3.0E-02		MADEP (6)	

Notes:

Note 1: For all PAH with no subchronic or chronic RfD, the chronic RfD for naphthalene was used (MADEP(6))
Note 6: Conversion of the inhalation Reference Concentration to an oral Reference Dose, using the equation:

RfD = RfC x Ventilation Rate / BW = (RfC x V) / BW = (RfD x 20 m^3/day) / 70 kg

MADEP = Massachusetts Department of Environmental Protection
mg/kg/day = milligrams per kilogram body weight per day
N/A = Not available

Reference:

MADEP(6) = Dose response values updated from MADEP's Excel Workbook: Toxicity Values used to derive MCP Method 1 Numerical Standards (6/2014)
(C = SC) = the Chronic Oral RfD was adopted as the Subchronic Oral RfD

Table 2.2
Noncancer Dose-Response Values:
Inhalation Reference Concentrations

Chemical Name	CAS Number	Subchronic Inhalation RfC (mg/cu m)	Uncertainty/ Modifying Factors	Source	Date Last Checked	Chronic Inhalation RfC (mg/cu m)	Uncertainty/ Modifying Factors	Source	Date Last Checked
acenaphthene	83-32-9	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
acenaphthylene	208-96-8	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
anthracene	120-12-7	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
barium	7440-39-3	5.0E-03		MADEP(5)		5.0E-04		MADEP(5)	
benzene	71-43-2	1.0E-02		MADEP(5)		1.0E-02		MADEP(5)	
benzo(a)anthracene	56-55-3	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
benzo(a)pyrene	50-32-8	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
benzo(b)fluoranthene	205-99-2	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
benzo(k)fluoranthene	207-08-9	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
benzo(ghi)perylene	191-24-2	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
beryllium	7440-41-7	2.0E-05		MADEP(5)		2.0E-05		MADEP(5)	
cadmium	7440-43-9	2.0E-05		MADEP(5)		2.0E-05		MADEP(5)	
chlordane	57-74-9	7.0E-03		MADEP(5)		7.0E-04		MADEP(5)	
chromium (III) (as metal)	16065-83-1	3.0E-04		MADEP(5)		1.0E-04		MADEP(5)	
chrysene	218-01-9	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
dibenzo(a,h)anthracene	53-70-3	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
DDE	72-55-9	1.8E-03		MADEP(5)		1.8E-03		MADEP(5)	
DDT	50-29-3	1.8E-03		MADEP(5)		1.8E-03		MADEP(5)	
dieldrin	60-57-1	1.8E-04		MADEP(5)		1.8E-04		MADEP(5)	
dioxin (TCDD equivalents)	1746-01-6			MADEP(5)				MADEP(5)	
fluoranthene	206-44-0	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
fluorene	86-73-7	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
indeno(123-cd)pyrene	193-39-5	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
lead	7439-92-1	1.0E-03		MADEP(5)		1.0E-03		MADEP(5)	
2-methylnaphthalene	91-57-6	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
naphthalene	91-20-3	3.0E-03		MADEP(5)		3.0E-03		MADEP(5)	
nickel	7440-02-0	1.0E-03		MADEP(5)		1.0E-03		MADEP(5)	
phenanthrene	85-01-8	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
polychlorinated biphenyls	1336-36-3	2.0E-05		MADEP(5)		2.0E-05		MADEP(5)	
pyrene	129-00-0	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	
thallium	7440-28-0	1.4E-05		MADEP(5)		1.4E-05		MADEP(5)	
toluene	108-88-3	5.0E+00		MADEP(5)		5.0E+00		MADEP(5)	
vanadium	7440-62-2	1.0E-03		MADEP(5)		1.0E-03		MADEP(5)	
zinc	7440-66-6	1.4E-03		MADEP(5)		1.4E-03		MADEP(5)	
C9-C18 Aliphatics	N/A	6.0E-01		MADEP(5)		2.0E-01		MADEP(5)	
C19-C36 Aliphatics	N/A	6.0E-01		Note 2		2.0E-01		Note 2	
C11-C22 Aromatics	N/A	5.0E-01		MADEP(5)		5.0E-02		MADEP(5)	

Notes:

Note 1: For PAHs with no RfCs, the chronic RfC for naphthalene was used as a surrogate
Note 2: For C19-C36 aliphatics, the chronic RfC for C9-C18 aliphatics was used as a surrogate
Note 3: Conversion of the oral Reference Dose to an inhalation Reference Concentration, using the equation:
RfC = RfD x BW / Ventilation Rate = (RfD x BW) /V = (RfD x 70 kg) / 20 m^3/day
MADEP = Massachusetts Department of Environmental Protection
mg/cu m = milligrams per cubic meter of air

References:

MADEP(5) = Toxicity Spreadsheet and reference page for in excel workbook "Development of MCP Risk-Based Levels for Soil and Groundwater" (6/2014)
(C = SC) = the Chronic Inhalation RfC was adopted as the Subchronic Inhalation RfC

Table 2.3
Relative Absorption Factors: Non-Cancer

Chemical Name	CAS Number	Soil Ingestion RAF	Water Ingestion RAF	Soil Dermal RAF	Water Dermal RAF
acenaphthene	83-32-9	0.3	1	0.1	1
acenaphthylene	208-96-8	0.3	1	0.1	1
anthracene	120-12-7	0.3	1	0.1	1
barium	7440-39-3	1	1	0.1	1
benzene	71-43-2	1	1	0.03	1
benzo(a)anthracene	56-55-3	0.3	1	0.02	1
benzo(a)pyrene	50-32-8	0.3	1	0.02	1
benzo(b)fluoranthene	205-99-2	0.3	1	0.02	1
benzo(k)fluoranthene	207-08-9	0.3	1	0.02	1
benzo(ghi)perylene	191-24-2	0.3	1	0.1	1
beryllium	7440-41-7	1	1	0.1	1
cadmium	7440-43-9	0.5	1	0.01	1
chlordane	57-74-9	1	1	0.04	1
chromium (III)	16065-83-1	1	1	0.1	1
chrysene	218-01-9	0.3	1	0.02	1
dibenzo(a,h)anthracene	53-70-3	0.3	1	0.02	1
DDD	72-54-8	1	1	0.2	1
DDE	72-55-9	1	1	0.03	1
DDT	50-29-3	1	1	0.03	1
dieldrin	60-57-1	1	1	0.1	1
dioxin (TCDD equivalent)	1746-01-6	1	1	0.1	1
fluoranthene	206-44-0	0.3	1	0.1	1
fluorene	86-73-7	0.3	1	0.1	1
indeno(123-cd)pyrene	193-39-5	0.3	1	0.02	1
lead	7439-92-1	0.5	1	0.006	1
2-methylnaphthalene	91-57-6	0.3	1	0.1	1
naphthalene	91-20-3	0.3	1	0.1	1
nickel	7440-02-0	1	1	0.2	1
phenanthrene	85-01-8	0.3	1	0.1	1
polychlorinated biphenyls	1336-36-3	1	1	0.1	1
pyrene	129-00-0	0.3	1	0.1	1
thallium	7440-28-0	1	1	0.01	1
toluene	108-88-3	1	1	0.03	1
vanadium	7440-62-2	1	1	0.1	1
zinc	7440-66-6	1	1	0.1	1
C9-C18 Aliphatics	N/A	1	1	0.2	1
C19-C36 Aliphatics	N/A	1	1	0.2	1
C11-C22 Aromatics	N/A	0.3	1	0.1	1

Notes: (1) A default value of one (1) was assigned to dermal contact with water.

References: MADEP, 2014. Dose response values updated from MADEP's Excel Workbook: Toxicity Values used to derive MCP Method 1 Numerical Standards (6/2014)

Table 2.4
Cancer Dose Response Values:
Oral Slope Factors

Chemical Name	CAS Number	Oral Slope Factor 1/(mg/kg/day)	Weight of Evidence Class	Source	Date Last Revised
acenaphthene	83-32-9			MADEP, 6/14	
acenaphthylene	208-96-8		D	MADEP, 6/14	
anthracene	120-12-7		D	MADEP, 6/14	
barium	7440-39-3			MADEP, 6/14	
benzene	71-43-2	5.5E-02	A	MADEP, 6/14	
benzo(a)anthracene	56-55-3	7.3E-01	B2	MADEP, 6/14	
benzo(a)pyrene	50-32-8	7.3E+00	B2	MADEP, 6/14	
benzo(b)fluoranthene	205-99-2	7.3E-01	B2	MADEP, 6/14	
benzo(k)fluoranthene	207-08-9	7.3E-02	B2	MADEP, 6/14	
benzo(ghi)perylene	191-24-2			MADEP, 6/14	
beryllium	7440-41-7		B1	MADEP, 6/14	
cadmium	7440-43-9		B1	MADEP, 6/14	
chlordane	57-74-9	3.5E-01	B2	MADEP, 6/14	
chromium (III)	16065-83-1			MADEP, 6/14	
chrysene	218-01-9	7.3E-02	B2	MADEP, 6/14	
dibenzo(a,h)anthracene	53-70-3	7.3E+00	B2	MADEP, 6/14	
DDE	72-55-9	3.4E-01	B2	MADEP, 6/14	
DDT	50-29-3	3.4E-01	B2	MADEP, 6/14	
dieldrin	60-57-1	1.6E+01	B2	MADEP, 6/14	
dioxin (TCDD equivalents)	1746-01-6	1.5E+05	B2	MADEP, 6/14	
fluoranthene	206-44-0		D	MADEP, 6/14	
fluorene	86-73-7			MADEP, 6/14	
indeno(123-cd)pyrene	193-39-5	7.3E-01	B2	MADEP, 6/14	
lead	7439-92-1		B2	MADEP, 6/14	
2-methylnaphthalene	91-57-6			MADEP, 6/14	
naphthalene	91-20-3			MADEP, 6/14	
nickel	7440-02-0		A	MADEP, 6/14	
phenanthrene	85-01-8		D	MADEP, 6/14	
polychlorinated biphenyls	1336-36-3	2.0E+00	B2	MADEP, 6/14	
pyrene	129-00-0		D	MADEP, 6/14	
thallium	7440-28-0			MADEP, 6/14	
toluene	108-88-3		D	MADEP, 6/14	
vanadium	7440-62-2			MADEP, 6/14	
zinc	7440-66-6		D	MADEP, 6/14	
C9-C18 Aliphatics	N/A			MADEP, 6/14	
C19-C36 Aliphatics	N/A			MADEP, 6/14	
C11-C22 Aromatics	N/A			MADEP, 6/14	

Notes: mg/kg/day = milligrams per kilogram body weight per day
N/A = not available

Weight of Evidence:
A = Human carcinogen
B1 = Probable human carcinogen
B2 = Probable human carcinogen
C = Possible human carcinogen
D = Not classifiable as to human carcinogenicity
E = Evidence of noncarcinogenicity for humans

References: MADEP, 6/14. MCP Toxicity excel spreadsheet used for the development of the MCP Numerical Standards

Table 2.5
Cancer Dose Response Values:
Inhalation Unit Risks Factors

Chemical Name	CAS Number	Unit Risk Factor 1/(mg/cu. m)	Weight of Evidence Class	Source	Date Last Revised
acenaphthene	83-32-9			MADEP 6/14	
acenaphthylene	208-96-8		D	MADEP 6/14	
anthracene	120-12-7		D	MADEP 6/14	
barium	7440-39-3			MADEP 6/14	
benzene	71-43-2	7.8E-03	A	MADEP 6/14	
benzo(a)anthracene	56-55-3	2.1E-01	B2	MADEP 6/14	
benzo(a)pyrene	50-32-8	2.1E+00	B2	MADEP 6/14	
benzo(b)fluoranthene	205-99-2	2.1E-01	B2	MADEP 6/14	
benzo(k)fluoranthene	207-08-9	2.1E-02	B2	MADEP 6/14	
benzo(ghi)perylene	191-24-2			MADEP 6/14	
beryllium	7440-41-7	2.4E+00	B1	MADEP 6/14	
cadmium	7440-43-9	1.8E+00	B1	MADEP 6/14	
chlordane	57-74-9	1.0E-01	B2	MADEP 6/14	
chromium (III)	16065-83-1			MADEP 6/14	
chrysene	218-01-9	2.1E-02	B2	MADEP 6/14	
dibenzo(a,h)anthracene	53-70-3	2.1E+00	B2	MADEP 6/14	
DDE	72-55-9	9.7E-02	B2	MADEP 6/14	
DDT	50-29-3	9.7E-02	B2	MADEP 6/14	
dieldrin	60-57-1	4.6E+00	B2	MADEP 6/14	
dioxin (TCDD equivalents)	1746-01-6	3.3E+04	B2	MADEP 6/14	
fluoranthene	206-44-0		D	MADEP 6/14	
fluorene	86-73-7			MADEP 6/14	
indeno(123-cd)pyrene	193-39-5	2.1E-01	B2	MADEP 6/14	
lead	7439-92-1		B2	MADEP 6/14	
2-methylnaphthalene	91-57-6			MADEP 6/14	
naphthalene	91-20-3			MADEP 6/14	
nickel	7440-02-0	4.8E-01	A	MADEP 6/14	
phenanthrene	85-01-8		D	MADEP 6/14	
polychlorinated biphenyls	1336-36-3	1.0E-01	B2	MADEP 6/14	
pyrene	129-00-0		D	MADEP 6/14	
thallium	7440-28-0			MADEP 6/14	
toluene	108-88-3		D	MADEP 6/14	
vanadium	7440-62-2			MADEP 6/14	
zinc	7440-66-6		D	MADEP 6/14	
C9-C18 Aliphatics	N/A			MADEP 6/14	
C19-C36 Aliphatics	N/A			MADEP 6/14	
C11-C22 Aromatics	N/A			MADEP 6/14	

Notes: mg/cu. m. = milligrams per cubic meter

Weight of Evidence:
A = Human carcinogen
B1 = Probable human carcinogen
B2 = Probable human carcinogen
C = Possible human carcinogen
D = Not classifiable as to human carcinogenicity
E = Evidence of noncarcinogenicity for humans
N/A = Not available

References: MADEP, 6/14. MCP Toxicity excel spreadsheet used for the development of the MCP Numerical Standards

Table 2.6
Cancer Dose Response Values: Relative Absorption Factors (RAFs)

Chemical Name	CAS Number	Soil Ingestion RAF Cancer	Water Ingestion RAF Cancer	Soil Dermal RAF Cancer	Water Dermal RAF Cancer
acenaphthene	83-32-9	NC	NC	NC	NC
acenaphthylene	208-96-8	NC	NC	NC	NC
anthracene	120-12-7	NC	NC	NC	NC
barium	7440-39-3	NC	NC	NC	NC
benzene	71-43-2	1	1	0.03	1
benzo(a)anthracene	56-55-3	0.3	1	0.02	1
benzo(a)pyrene	50-32-8	0.3	1	0.02	1
benzo(b)fluoranthene	205-99-2	0.3	1	0.02	1
benzo(k)fluoranthene	207-08-9	0.3	1	0.02	1
benzo(ghi)perylene	191-24-2	NC	NC	NC	NC
beryllium	7440-41-7	1	1	0.03	1
cadmium	7440-43-9	NC	NC	NC	NC
chromium (III)	16065-83-1	NC	NC	NC	NC
chrysene	218-01-9	0.3	1	0.02	1
dibenzo(a,h)anthracene	53-70-3	0.3	1	0.02	1
DDE	72-55-9	1	1	0.03	1
DDT	50-29-3	1	1	0.03	1
dieldrin	60-57-1	1	1	0.1	1
dioxin (TCDD equivalents)	1746-01-6	1	1	0.1	1
ethylbenzene	100-41-4	NC	NC	NC	NC
fluoranthene	206-44-0	NC	NC	NC	NC
fluorene	86-73-7	NC	NC	NC	NC
indeno(123-cd)pyrene	193-39-5	0.3	1	0.02	1
lead	7439-92-1	NC	NC	NC	NC
2-methylnaphthalene	91-57-6	NC	NC	NC	NC
naphthalene	91-20-3	NC	NC	NC	NC
nickel	7440-02-0	NC	NC	NC	NC
phenanthrene	85-01-8	NC	NC	NC	NC
polychlorinated biphenyls	1336-36-3	1	1	0.1	1
pyrene	129-00-0	NC	NC	NC	NC
thallium	7440-28-0	NC	NC	NC	NC
toluene	108-88-3	NC	NC	NC	NC
vanadium	7440-62-2	NC	NC	NC	NC
zinc	7440-66-6	NC	NC	NC	NC
C9-C18 Aliphatics	N/A	NC	NC	NC	NC
C19-C36 Aliphatics	N/A	NC	NC	NC	NC
C11-C22 Aromatics	N/A	NC	NC	NC	NC

Notes: (1) RAF values from MADEP (1994). Default value of one (1) assigned to dermal contact with water.
NC = RAF not provided because compound is not a Class A, B1, B2 or, when applicable, C carcinogen
N/A = not available or because no oral cancer slope factor is available.

References: MADEP, 6/14. MCP Toxicity excel spreadsheet used for the development of the MCP Numerical Standards.

Table 3.1
Calculation of Average Daily Dose for Soil Exposure: Child Resident, aged 1 Year

Receptor: Child Resident, aged 1 year

	Exposure Point:	Courtyard 0-3 Foot Interval		Courtyard 3-6 Foot Interval		Courtyard 6-15 Foot Interval		Stockpiled Fuel Oil Vault Sands SP-3		Derivation of PCB Cleanup Standard		0.00E+00	
Chemical Name	**CAS Number**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**
acenaphthene	83-32-9	6.62E-07	3.40E-07	4.05E-07	2.08E-07	2.33E-07	1.20E-07	5.45E-07	2.80E-07	4.05E-07	2.08E-07		
acenaphthylene	208-96-8	1.71E-07	8.79E-08	1.32E-07	6.79E-08	1.71E-07	8.79E-08	7.00E-08	3.59E-08	1.32E-07	6.79E-08		
anthracene	120-12-7	1.48E-06	7.59E-07	7.78E-07	3.99E-07	7.47E-07	3.83E-07	1.17E-06	5.99E-07	7.78E-07	3.99E-07		
barium	7440-39-3	7.70E-05	1.32E-04	3.74E-05	6.39E-05	2.41E-05	4.13E-05	8.09E-05	1.38E-04	3.74E-05	6.39E-05		
benzene	71-43-2			1.05E-08	5.99E-08	1.84E-08	1.05E-07			1.05E-08	5.99E-08		
benzo(a)anthracene	56-55-3	6.54E-07	1.68E-06	3.27E-07	8.39E-07	1.09E-07	2.80E-07	4.67E-07	1.20E-06	3.27E-07	8.39E-07		
benzo(a)pyrene	50-32-8	5.91E-07	1.52E-06	2.96E-07	7.59E-07	1.04E-07	2.68E-07	4.05E-07	1.04E-06	2.96E-07	7.59E-07		
benzo(b)fluoranthene	205-99-2	7.63E-07	1.96E-06	4.05E-07	1.04E-06	1.29E-07	3.32E-07	5.45E-07	1.40E-06	4.05E-07	1.04E-06		
benzo(k)fluoranthene	207-08-9	2.80E-07	7.19E-07	1.56E-07	3.99E-07	6.38E-08	1.64E-07	2.18E-07	5.59E-07	1.56E-07	3.99E-07		
benzo(ghi)perylene	191-24-2	1.63E-06	8.39E-07	8.56E-07	4.39E-07	3.58E-07	1.84E-07	1.09E-06	5.59E-07	8.56E-07	4.39E-07		
beryllium	7440-41-7	3.50E-06	5.99E-06	4.75E-06	8.12E-06	1.09E-07	1.86E-07	7.24E-07	1.24E-06	4.75E-06	8.12E-06		
chlordane	57-74-9			3.42E-08	1.46E-07					3.42E-08	1.46E-07		
chromium (III)	16065-83-1	2.72E-05	4.66E-05	1.40E-05	2.40E-05	8.56E-06	1.46E-05	2.65E-05	4.53E-05	1.40E-05	2.40E-05		
chrysene	218-01-9	7.16E-07	1.84E-06	3.42E-07	8.79E-07	1.23E-07	3.16E-07	4.36E-07	1.12E-06	3.42E-07	8.79E-07		
dibenzo(a,h)anthracene	53-70-3	9.96E-08	2.56E-07	5.91E-08	1.52E-07	4.20E-08	1.08E-07	9.18E-08	2.36E-07	5.91E-08	1.52E-07		
DDE	72-55-9	1.10E-08	6.26E-08										
DDT	50-29-3	2.10E-08	1.20E-07	7.47E-09	4.26E-08			2.57E-08	1.46E-07	7.47E-09	4.26E-08		
dieldrin	60-57-1	7.24E-08	1.24E-07	2.18E-08	3.73E-08			1.32E-07	2.26E-07	2.18E-08	3.73E-08		
dioxin (TCDD equivalents)	1746-01-6	3.60E-11	6.15E-11	1.05E-11	1.80E-11	2.31E-12	3.95E-12	3.34E-11	5.71E-11	2.57E-11	4.39E-11		
fluoranthene	206-44-0	7.55E-06	3.87E-06	4.12E-06	2.12E-06	2.18E-06	1.12E-06	5.45E-06	2.80E-06	4.12E-06	2.12E-06		
fluorene	86-73-7	7.00E-07	3.59E-07	4.28E-07	2.20E-07	1.56E-06	7.99E-07	7.24E-07	3.71E-07	4.28E-07	2.20E-07		
indeno(123-cd)pyrene	193-39-5	3.74E-07	9.59E-07	1.87E-07	4.79E-07	7.47E-08	1.92E-07	2.18E-07	5.59E-07	1.87E-07	4.79E-07		
lead	7439-92-1	1.82E-05	2.60E-04	4.44E-06	6.32E-05	3.32E-06	4.73E-05	1.97E-05	2.80E-04	4.44E-06	6.32E-05		
2-methylnaphthalene	91-57-6	2.49E-07	1.28E-07	6.93E-07	3.55E-07	3.04E-06	1.56E-06	2.26E-07	1.16E-07	6.93E-07	3.55E-07		
naphthalene	91-20-3	5.68E-07	2.92E-07	2.10E-07	1.08E-07	1.40E-06	7.19E-07	4.59E-07	2.36E-07	2.10E-07	1.08E-07		
nickel (soluble salts)	7440-02-0	4.83E-05	4.13E-05	3.74E-05	3.20E-05	1.56E-05	1.33E-05	3.89E-05	3.33E-05	3.74E-05	3.20E-05		
phenanthrene	85-01-8	5.99E-06	3.08E-06	3.58E-06	1.84E-06	2.57E-06	1.32E-06	4.59E-06	2.36E-06	3.58E-06	1.84E-06		
polychlorinated biphenyls, as PCB-1254	1336-36-3	3.19E-05	5.46E-05	3.19E-06	5.46E-06	7.00E-07	1.20E-06	1.01E-05	1.73E-05	7.78E-06	1.33E-05		
pyrene	129-00-0	7.16E-06	3.67E-06	3.58E-06	1.84E-06	1.56E-06	7.99E-07	3.89E-06	2.00E-06	3.58E-06	1.84E-06		
thallium	7440-28-0							2.72E-07	4.66E-06				
toluene	108-88-3			3.60E-08	2.05E-07	1.07E-07	6.12E-07			3.60E-08	2.05E-07		
vanadium	7440-62-2	2.70E-04	4.62E-04	1.13E-04	1.93E-04	1.34E-04	2.29E-04	8.33E-05	1.42E-04	1.13E-04	1.93E-04		
zinc	7440-66-6	1.30E-04	2.22E-04	6.69E-05	1.15E-04	3.11E-05	5.33E-05	1.25E-04	2.14E-04	6.69E-05	1.15E-04		
C9-C18 Aliphatics	N/A	6.85E-05	5.86E-05	2.52E-04	2.16E-04	9.48E-04	8.11E-04			2.52E-04	2.16E-04		
C19-C36 Aliphatics	N/A	2.79E-04	2.38E-04	4.09E-04	3.50E-04	1.85E-03	1.58E-03			4.09E-04	3.50E-04		
C11-C22 Aromatics	N/A	2.31E-04	1.19E-04	4.33E-04	2.22E-04	1.22E-03	6.26E-04			4.33E-04	2.22E-04		

Table 3.1
Calculation of Average Daily Dose for Soil Exposure: Child Resident, aged 1 Year

Formula: Daily Dose (ADD) for exposure to soils via ingestion (ing) and dermal contact

$$ADD\text{-}dermal = \frac{[OHM\text{-}soil]*SA*AF*RAF*EF*ED*EP*C}{BW*AP}$$

$$ADD\text{-}ing = \frac{[OHM\text{-}soil]*IR*RAF*EF*ED*EP*C}{BW*AP}$$

Unit: ADD, mg/kg/day

Receptor: Child Resident, aged 1 to 8 years (Chronic) and aged 1 year (Subchronic)

Description	Abbreviation	Unit	Default Value	Source	Site-Specific Value	Source / Description	Input Value
Exposure point concentration	[OHM-soil]	mg/kg			See Soil EPC Table		See Soil EPC Table
Skin surface area in contact with soil on days exposed	SA	square centimeter/day	2431	[2], child, aged 1 to 8 years (face, hands, forearms, lower legs and feet)	1670	child, aged 1 to 2 years (face, hands, forearms, lower legs and feet)	1.67E+03
Mass of soil adhered to the unit surface area of skin exposed	AF	mg/sq. cm.	0.35	[1], for child resident			3.50E-01
Relative Absorption Factor	RAF	unitless	See RAF Table				See RAF Table
# exposure events during EP / # days in EP	EF	events/year	150	[2], 5 days per week during the 30 warmest weeks of the year	52	Two days per week during a six-month construction project	5.20E+01
Exposure duration: typical duration of each exposure event	ED	years/event	2.74E-03	1 day per event or 1/365 of a year per event			2.74E-03
Exposure period: period of time over which exposure may occur	EP	years	7	[2], child, aged 1 to 8 years	1.0	subchronic exposure of 1 year old boy or girl (Subchronic)	1.00E+00
Unit Conversion Factor	C	kg/mg	1.00E-06	for dermal contact			1.00E-06
Unit Conversion Factor	C	kg/mg	1.00E-06	for ingestion			1.00E-06
Body weight of the receptor during the AP	BW	kg	17	[2], child, aged 1 to 8 years	1.07E+01	subchronic exposure of 1 year old boy or girl	1.07E+01
Averaging Period	AP	years	7	[2]	1.0	subchronic exposure of 1 year old boy or girl	1.00E+00
Ingestion rate	IR	mg/day	100	[2]			1.00E+02

References:

[1] MADEP's Technical Update, Weighted Skin-Soil Adherence Factors, April 2002.
[2] MADEP's Guidance for Disposal Site Risk Characterization in Support of the Massachusetts Contingency Plan, Interim Final Policy BWSC/ORS-95-141

Table 3.2
Calculation of Average Daily Exposure for Dust: Child Resident, aged 1

Receptor: Child Resident, aged 1 year								
Chemical Name	**CAS Number**	**Courtyard 0-3 Foot Interval**	**Courtyard 3-6 Foot Interval**	**Courtyard 6-15 Foot Interval**	**Stockpiled Fuel Oil Vault Sands SP-3**	**Derivation of PCB Cleanup Standard**	**0.00**	**0.00**
acenaphthene	83-32-9	2.5E-08	1.6E-08	9.0E-09	2.1E-08	1.6E-08		
acenaphthylene	208-96-8	6.6E-09	5.1E-09	6.6E-09	2.7E-09	5.1E-09		
anthracene	120-12-7	5.7E-08	3.0E-08	2.9E-08	4.5E-08	3.0E-08		
barium	7440-39-3	3.0E-06	1.4E-06	9.3E-07	3.1E-06	1.4E-06		
benzene	71-43-2		1.3E-09	2.4E-09		1.3E-09		
benzo(a)anthracene	56-55-3	1.3E-07	6.3E-08	2.1E-08	9.0E-08	6.3E-08		
benzo(a)pyrene	50-32-8	1.1E-07	5.7E-08	2.0E-08	7.8E-08	5.7E-08		
benzo(b)fluoranthene	205-99-2	1.5E-07	7.8E-08	2.5E-08	1.0E-07	7.8E-08		
benzo(k)fluoranthene	207-08-9	5.4E-08	3.0E-08	1.2E-08	4.2E-08	3.0E-08		
benzo(ghi)perylene	191-24-2	6.3E-08	3.3E-08	1.4E-08	4.2E-08	3.3E-08		
beryllium	7440-41-7	1.3E-07	1.8E-07	4.2E-09	2.8E-08	1.8E-07		
chlordane	57-74-9		3.3E-09			3.3E-09		
chromium (III)	16065-83-1	1.0E-06	5.4E-07	3.3E-07	1.0E-06	5.4E-07		
chrysene	218-01-9	1.4E-07	6.6E-08	2.4E-08	8.4E-08	6.6E-08		
dibenzo(a,h)anthracene	53-70-3	1.9E-08	1.1E-08	8.1E-09	1.8E-08	1.1E-08		
DDE	72-55-9	1.4E-09						
DDT	50-29-3	2.7E-09	9.6E-10		3.3E-09	9.6E-10		
dieldrin	60-57-1	2.8E-09	8.4E-10		5.1E-09	8.4E-10		
dioxin (TCDD equivalents)	1746-01-6	1.4E-12	4.0E-13	8.9E-14	1.3E-12	9.9E-13		
fluoranthene	206-44-0	2.9E-07	1.6E-07	8.4E-08	2.1E-07	1.6E-07		
fluorene	86-73-7	2.7E-08	1.6E-08	6.0E-08	2.8E-08	1.6E-08		
indeno(123-cd)pyrene	193-39-5	7.2E-08	3.6E-08	1.4E-08	4.2E-08	3.6E-08		
lead	7439-92-1	1.2E-05	2.8E-06	2.1E-06	1.3E-05	2.8E-06		
2-methylnaphthalene	91-57-6	9.6E-09	2.7E-08	1.2E-07	8.7E-09	2.7E-08		
naphthalene	91-20-3	2.2E-08	8.1E-09	5.4E-08	1.8E-08	8.1E-09		
nickel (soluble salts)	7440-02-0	9.3E-07	7.2E-07	3.0E-07	7.5E-07	7.2E-07		
phenanthrene	85-01-8	2.3E-07	1.4E-07	9.9E-08	1.8E-07	1.4E-07		
polychlorinated biphenyls, as PCB-1254	1336-36-3	1.2E-06	1.2E-07	2.7E-08	3.9E-07	3.0E-07		
pyrene	129-00-0	2.8E-07	1.4E-07	6.0E-08	1.5E-07	1.4E-07		
thallium	7440-28-0				1.0E-07			
toluene	108-88-3		4.6E-09	1.4E-08		4.6E-09		
vanadium	7440-62-2	1.0E-05	4.3E-06	5.1E-06	3.2E-06	4.3E-06		
zinc	7440-66-6	5.0E-06	2.6E-06	1.2E-06	4.8E-06	2.6E-06		
C9-C18 Aliphatics	N/A	1.3E-06	4.8E-06	1.8E-05		4.8E-06		
C19-C36 Aliphatics	N/A	5.4E-06	7.9E-06	3.6E-05		7.9E-06		
C11-C22 Aromatics	N/A	8.9E-06	1.7E-05	4.7E-05		1.7E-05		

Table 3.2
Calculation of Average Daily Exposure for Dust: Child Resident, aged 1

Formula: Average Daily Exposure (ADE) via inhalation (ihl) of dusts

ADE-ihl = $\frac{[\text{OHM-dust}]*EF*ED*EP*C}{AP}$ **Unit:** ADE, mg/cu m

Receptor: Child Resident, aged 1 to 8 years (Chronic) and aged 1 year (Subchronic)

Description	Abbreviation	Unit	Default Value	Source	Site-Specific Value	Source / Description	Input Value
Exposure point concentration	[OHM-dust]	ug/cu. m.			See Dust EPC Table		See Dust EPC Table
Exposure frequency: # exposure events during EP / # days in EP	EF	events/year	150	[2], 5 days per week during the 30 warmest weeks of the year	182	Seven days per week during a six-month construction project	1.82E+02
Exposure duration: typical duration of each exposure event	ED	years/event	2.74E-03	1 day per event, or 1/365 of a year per event			2.74E-03
Exposure period: period of time over which exposure may occur	EP	years	7	[1], from age 1 to 8 years	1.00E+00	subchronic exposure of 1 year old boy or girl	1.00E+00
Unit Conversion Factor	C	mg/ug	1.00E-03	for inhalation			1.00E-03
Averaging Period	AP	years	7	[1]	1.00E+00	subchronic exposure of 1 year old boy or girl	1.00E+00

References:

[1] MADEP's Guidance for Disposal Site Risk Characterization in Support of the Massachusetts Contingency Plan, Interim Final Policy BWSC/ORS-95-141

Table 3.3
Calculation of Lifetime Average Daily Dose for Soil Exposure: Resident, aged 1 to 2 Years

Receptor: Resident, aged 1-31 years

		Exposure Point:	Courtyard 0-3 Foot Interval		Courtyard 3-6 Foot Interval		Courtyard 6-15 Foot Interval		Stockpiled Fuel Oil Vault Sands SP-3		Derivation of PCB Cleanup Standard	
Chemical Name	**CAS Number**	**Weight of Evidence Class**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**	**Dermal Contact**	**Incidental Ingestion**
benzene	71-43-2	A			1.50E-10	2.91E-09	2.63E-10	5.10E-09			1.50E-10	2.91E-09
benzo(a)anthracene	56-55-3		9.34E-09	8.14E-08	4.67E-09	4.07E-08	1.56E-09	1.36E-08	6.67E-09	5.81E-08	4.67E-09	4.07E-08
benzo(a)pyrene	50-32-8		8.45E-09	7.37E-08	4.22E-09	3.68E-08	1.49E-09	1.30E-08	5.78E-09	5.04E-08	4.22E-09	3.68E-08
benzo(b)fluoranthene	205-99-2		1.09E-08	9.50E-08	5.78E-09	5.04E-08	1.85E-09	1.61E-08	7.78E-09	6.78E-08	5.78E-09	5.04E-08
benzo(k)fluoranthene	207-08-9		4.00E-09	3.49E-08	2.22E-09	1.94E-08	9.12E-10	7.95E-09	3.11E-09	2.71E-08	2.22E-09	1.94E-08
beryllium	7440-41-7											
chlordane	57-74-9				6.11E-10	7.11E-09					6.11E-10	7.11E-09
chrysene	218-01-9		1.02E-08	8.92E-08	4.89E-09	4.26E-08	1.76E-09	1.53E-08	6.23E-09	5.43E-08	4.89E-09	4.26E-08
dibenzo(a,h)anthracene	53-70-3		1.42E-09	1.24E-08	8.45E-10	7.37E-09	6.00E-10	5.23E-09	1.31E-09	1.14E-08	8.45E-10	7.37E-09
DDE	72-55-9		1.57E-10	3.04E-09								
DDT	50-29-3		3.00E-10	5.81E-09	1.07E-10	2.07E-09			3.67E-10	7.11E-09	1.07E-10	2.07E-09
dieldrin	60-57-1		1.03E-09	6.01E-09	3.11E-10	1.81E-09			1.89E-09	1.10E-08	3.11E-10	1.81E-09
dioxin (TCDD equivalents)	1746-01-6		5.14E-13	2.99E-12	1.50E-13	8.72E-13	3.30E-14	1.92E-13	4.77E-13	2.77E-12	3.67E-13	2.13E-12
indeno(123-cd)pyrene	193-39-5		5.34E-09	4.65E-08	2.67E-09	2.33E-08	1.07E-09	9.30E-09	3.11E-09	2.71E-08	2.67E-09	2.33E-08
nickel	7440-02-0											
polychlorinated biphenyls	1336-36-3		4.56E-07	2.65E-06	4.56E-08	2.65E-07	1.00E-08	5.81E-08	1.45E-07	8.40E-07	1.11E-07	6.46E-07

Formula: Lifetime Average Daily Dose (LADD) for exposure to soils via ingestion (ing) and dermal contact

LADD-dermal = $\frac{[\text{OHM-soil}]*SA*AF*RAF*EF*ED*EP*C}{BW*AP}$

LADD-ing = $\frac{[\text{OHM-soil}]*IR*RAF*EF*ED*EP*C}{BW*AP}$

Unit: LADD, mg/kg/day

Receptor: Resident, aged 1 to 31 years

Description	**Abbreviation**	**Unit**	**Default Value**	**Source**	**Site-Specific Value**	**Source / Description**	**Input Value**
Exposure point concentration	[OHM-soil]	mg/kg			See Soil EPC Table		See Soil EPC Table
Skin surface area in contact with soil on days exposed	SA	square centimeter/day	4427	[1], child, aged 8 to 15 years (face, hands, forearms, lower legs and feet)			0.00E+00
			5653	[1], adult, aged 15 to 31 years (face, hands, forearms, lower legs and feet)			0.00E+00
			2431	[1], child, aged 1-8 years (face, hands, forearms, lower legs and feet)	1670	child, aged 1 to 2 years (face, hands, forearms, lower legs and feet)	1.67E+03
Mass of soil adhered to the unit surface area of skin exposed	AF	mg/sq. cm.	0.35	[2], child, aged 1-8 years	3.50E-01	child, aged 1 to 2 years	3.50E-01
			0.13	[2], adult, aged 15-31 years			0.00E+00
			0.14	[2], older child, aged 8-15 years			0.00E+00
Relative Absorption Factor	RAF	unitless	See RAF Table				See RAF Table
Exposure frequency: # exposure events during EP / # days in EP	EF	events/year	150	[1] 5 days per week during the 30 warmest weather weeks of the year	52	Exposure presumed to occur two days per week during a six month construction period	5.20E+01
Exposure duration: typical duration of each exposure event	ED	years/event	2.74E-03	1 day per event or 1/365 of a year per event			2.74E-03
Exposure period: period of time over which exposure may occur	EP	years	7	[1], child, aged 8 to 15 years			7.00E+00
			16	[1], adult, aged 15 to 31 years			1.60E+01
			7	[1], young child, aged 1-8 years	1.0	subchronic exposure of 1 year old boy or girl (Subchronic)	1.00E+00
Unit Conversion Factor	C	kg/mg	1.00E-06	for dermal contact			1.00E-06
Unit Conversion Factor	C	kg/mg	1.00E-06	for ingestion			1.00E-06
Body weight of the receptor during the AP	BW	kg	39.9	[1], child, aged 8-15 years			3.99E+01
			58.7	[1], adult, aged 15 to 31 years			5.87E+01
			17.0	[1], young child, aged 1-8 years	1.07E+01	subchronic exposure of 1 year old boy or girl	1.07E+01
Averaging Period	AP	years	70	[1]			7.00E+01
Ingestion rate	IR	mg/day	50	[1], age 8 or greater			5.00E+01
			100	[1], age 1-8 years			1.00E+02

References:

[1] MADEP's Guidance for Disposal Site Risk Characterization in Support of the Massachusetts Contingency Plan, Interim Final Policy BWSC/ORS-95-141 [Updated using exposure assumptions of MADEP's Method 1 Numerical Standard Development Workbook, 5/2009].

[2] MADEP's Technical Update, Weighted Skin-Soil Adherence Factors, April 2002.

Table 3.4
Calculation of Lifetime Average Daily Exposure from Inhalation of Dust: Resident, aged 1 to 2 Years

Receptor: Resident, aged 1 to 31 years

Chemical Name	CAS Number	Weight of Evidence Class	Courtyard 0-3 Foot Interval	Courtyard 3-6 Foot Interval	Courtyard 6-15 Foot Interval	Stockpiled Fuel Oil Vault Sands SP-3	Derivation of PCB Cleanup Standard		
benzene	71-43-2			1.9E-11	3.4E-11		1.9E-11		
benzo(a)anthracene	56-55-3		1.8E-09	9.0E-10	3.0E-10	1.3E-09	9.0E-10		
benzo(a)pyrene	50-32-8		1.6E-09	8.1E-10	2.9E-10	1.1E-09	8.1E-10		
benzo(b)fluoranthene	205-99-2		2.1E-09	1.1E-09	3.5E-10	1.5E-09	1.1E-09		
benzo(k)fluoranthene	207-08-9		7.7E-10	4.3E-10	1.8E-10	6.0E-10	4.3E-10		
beryllium	7440-41-7		1.9E-09	2.6E-09	6.0E-11	4.0E-10	2.6E-09		
chlordane	57-74-9			4.7E-11			4.7E-11		
chrysene	218-01-9		2.0E-09	9.4E-10	3.4E-10	1.2E-09	9.4E-10		
dibenzo(a,h)anthracene	53-70-3		2.7E-10	1.6E-10	1.2E-10	2.5E-10	1.6E-10		
DDE	72-55-9		2.0E-11						
DDT	50-29-3		3.8E-11	1.4E-11		4.7E-11	1.4E-11		
dieldrin	60-57-1		4.0E-11	1.2E-11		7.3E-11	1.2E-11		
dioxin (TCDD equivalents)	1746-01-6		2.0E-14	5.8E-15	1.3E-15	1.8E-14	1.4E-14		
indeno(123-cd)pyrene	193-39-5		1.0E-09	5.1E-10	2.1E-10	6.0E-10	5.1E-10		
nickel	7440-02-0		1.3E-08	1.0E-08	4.3E-09	1.1E-08	1.0E-08		
polychlorinated biphenyls	1336-36-3		1.8E-08	1.8E-09	3.8E-10	5.6E-09	4.3E-09		

A = USEPA Known Human Carcinogen
B1 or B2 = USEPA Probable Human Carcinogen
C = USEPA Possible Human Carcinogen
NC or blank space = Not a carcinogen or insufficient information

Formula: Lifetime Average Daily Exposure (LADE) via inhalation (ihl) of dusts

$$\text{LADE-ihl} = \frac{[\text{OHM-dust}]*EF*ED*EP*C}{AP}$$

Unit: LADE, mg/cu m

Receptor: Resident, aged 1 to 31 years

Description	Abbreviation	Unit	Default Value	Source	Site-Specific Value	Source / Description	Input Value
Exposure point concentration	[OHM-dust]	ug/cu. m.			See Dust EPC Table		See Dust EPC Table
Exposure frequency: # exposure events during EP / # days in EP	EF	events/year	150	[1] 5 days per week during the 30 warmest weather weeks of the year			0.00E+00
			150	[1] 5 days per week during the 30 warmest weather weeks of the year	182	Seven days per week during a six-month construction project, during age 1-2 years	1.82E+02
Exposure duration: typical duration of each exposure event	ED	years/event	2.74E-03	1 day per event or 1/365 of a year			2.74E-03
Exposure period: period of time over which exposure may occur	EP	years	23	[1], from age 8 to 31 years			2.30E+01
			7	[1], from age 1 to 8 years	1.00E+00	Presume exposure occurs during a construction project from age 1 to 2 years of age, to either a girl or boy.	1.00E+00
Unit Conversion Factor	C	mg/ug	1.00E-03	for inhalation			1.00E-03
Averaging Period	AP	years	70	[1]			7.00E+01

References:

[1] MADEP's Guidance for Disposal Site Risk Characterization in Support of the Massachusetts Contingency Plan, Interim Final Policy BWSC/ORS-95-141

Table 4.1
Calculation of Hazard Index (HI) for Exposure to Soil and Dust: Child Resident, aged 1 Year

Receptor: Child Resident, aged 1 year

	Exposure Point:	Courtyard 0-3 Foot Interval			Courtyard 3-6 Foot Interval			Courtyard 6-15 Foot Interval			Stockpiled Fuel Oil Vault Sands SP-3			Derivation of PCB Cleanup Standard		
Chemical Name	**CAS Number**	**Dermal Contact**	**Incidental Ingestion**	**Dust Inhalation**	**Dermal Contact**	**Incidental Ingestion**	**Dust Inhalation**	**Dermal Contact**	**Incidental Ingestion**	**Dust Inhalation**	**Dermal Contact**	**Incidental Ingestion**	**Dust Inhalation**	**Dermal Contct**	**Incidental Ingestion**	**Dust Inhalation**
acenaphthene	83-32-9	3.3E-06	1.7E-06	5.1E-08	2.0E-06	1.0E-06	3.1E-08	1.2E-06	6.0E-07	1.8E-08	2.7E-06	1.4E-06	4.2E-08	2.0E-06	1.0E-06	3.1E-08
acenaphthylene	208-96-8	5.7E-07	2.9E-07	1.3E-08	4.4E-07	2.3E-07	1.0E-08	5.7E-07	2.9E-07	1.3E-08	2.3E-07	1.2E-07	5.4E-09	4.4E-07	2.3E-07	1.0E-08
anthracene	120-12-7	1.5E-06	7.6E-07	1.1E-07	7.8E-07	4.0E-07	6.0E-08	7.5E-07	3.8E-07	5.7E-08	1.2E-06	6.0E-07	9.0E-08	7.8E-07	4.0E-07	6.0E-08
barium	7440-39-3	1.1E-03	1.9E-03	5.9E-04	5.3E-04	9.1E-04	2.9E-04	3.4E-04	5.9E-04	1.9E-04	1.2E-03	2.0E-03	6.2E-04	5.3E-04	9.1E-04	2.9E-04
benzene	71-43-2				1.1E-06	6.0E-06	1.3E-07	1.8E-06	1.1E-05	2.4E-07				1.1E-06	6.0E-06	1.3E-07
benzo(a)anthracene	56-55-3	2.2E-06	5.6E-06	2.5E-07	1.1E-06	2.8E-06	1.3E-07	3.6E-07	9.3E-07	4.2E-08	1.6E-06	4.0E-06	1.8E-07	1.1E-06	2.8E-06	1.3E-07
benzo(a)pyrene	50-32-8	2.0E-06	5.1E-06	2.3E-07	9.9E-07	2.5E-06	1.1E-07	3.5E-07	8.9E-07	4.0E-08	1.3E-06	3.5E-06	1.6E-07	9.9E-07	2.5E-06	1.1E-07
benzo(b)fluoranthene	205-99-2	2.5E-06	6.5E-06	2.9E-07	1.3E-06	3.5E-06	1.6E-07	4.3E-07	1.1E-06	5.0E-08	1.8E-06	4.7E-06	2.1E-07	1.3E-06	3.5E-06	1.6E-07
benzo(k)fluoranthene	207-08-9	9.3E-07	2.4E-06	1.1E-07	5.2E-07	1.3E-06	6.0E-08	2.1E-07	5.5E-07	2.5E-08	7.3E-07	1.9E-06	8.4E-08	5.2E-07	1.3E-06	6.0E-08
benzo(ghi)perylene	191-24-2	5.4E-06	2.8E-06	1.3E-07	2.9E-06	1.5E-06	6.6E-08	1.2E-06	6.1E-07	2.8E-08	3.6E-06	1.9E-06	8.4E-08	2.9E-06	1.5E-06	6.6E-08
beryllium	7440-41-7	7.0E-04	1.2E-03	6.7E-03	9.5E-04	1.6E-03	9.1E-03	2.2E-05	3.7E-05	2.1E-04	1.4E-04	2.5E-04	1.4E-03	9.5E-04	1.6E-03	9.1E-03
chlordane	57-74-9				6.8E-05	2.9E-04	4.7E-07							6.8E-05	2.9E-04	4.7E-07
chromium (III)	16065-83-1	1.8E-05	3.1E-05	3.5E-03	9.3E-06	1.6E-05	1.8E-03	5.7E-06	9.8E-06	1.1E-03	1.8E-05	3.0E-05	3.4E-03	9.3E-06	1.6E-05	1.8E-03
chrysene	218-01-9	2.4E-06	6.1E-06	2.8E-07	1.1E-06	2.9E-06	1.3E-07	4.1E-07	1.1E-06	4.7E-08	1.5E-06	3.7E-06	1.7E-07	1.1E-06	2.9E-06	1.3E-07
dibenzo(a,h)anthracene	53-70-3	3.3E-07	8.5E-07	3.8E-08	2.0E-07	5.1E-07	2.3E-08	1.4E-07	3.6E-07	1.6E-08	3.1E-07	7.9E-07	3.5E-08	2.0E-07	5.1E-07	2.3E-08
DDE	72-55-9	2.2E-05	1.3E-04	8.0E-07												
DDT	50-29-3	4.2E-05	2.4E-04	1.5E-06	1.5E-05	8.5E-05	5.5E-07				5.1E-05	2.9E-04	1.9E-06	1.5E-05	8.5E-05	5.5E-07
dieldrin	60-57-1	1.4E-03	2.5E-03	1.6E-05	4.4E-04	7.5E-04	4.8E-06				2.6E-03	4.5E-03	2.9E-05	4.4E-04	7.5E-04	4.8E-06
dioxin (TCDD equivalents)	1746-01-6	5.1E-02	8.8E-02		1.5E-02	2.6E-02		3.3E-03	5.6E-03		4.8E-02	8.2E-02		3.7E-02	6.3E-02	
fluoranthene	206-44-0	1.9E-05	9.7E-06	5.8E-07	1.0E-05	5.3E-06	3.2E-07	5.4E-06	2.8E-06	1.7E-07	1.4E-05	7.0E-06	4.2E-07	1.0E-05	5.3E-06	3.2E-07
fluorene	86-73-7	1.8E-06	9.0E-07	5.4E-08	1.1E-06	5.5E-07	3.3E-08	3.9E-06	2.0E-06	1.2E-07	1.8E-06	9.3E-07	5.6E-08	1.1E-06	5.5E-07	3.3E-08
indeno(123-cd)pyrene	193-39-5	1.2E-06	3.2E-06	1.4E-07	6.2E-07	1.6E-06	7.2E-08	2.5E-07	6.4E-07	2.9E-08	7.3E-07	1.9E-06	8.4E-08	6.2E-07	1.6E-06	7.2E-08
lead	7439-92-1	2.4E-02	3.5E-01	1.2E-02	5.9E-03	8.4E-02	2.8E-03	4.4E-03	6.3E-02	2.1E-03	2.6E-02	3.7E-01	1.3E-02	5.9E-03	8.4E-02	2.8E-03
2-methylnaphthalene	91-57-6	6.2E-05	3.2E-05	1.9E-08	1.7E-04	8.9E-05	5.3E-08	7.6E-04	3.9E-04	2.3E-07	5.6E-05	2.9E-05	1.7E-08	1.7E-04	8.9E-05	5.3E-08
naphthalene	91-20-3	2.8E-06	1.5E-06	7.3E-06	1.1E-06	5.4E-07	2.7E-06	7.0E-06	3.6E-06	1.8E-05	2.3E-06	1.2E-06	5.9E-06	1.1E-06	5.4E-07	2.7E-06
nickel (soluble salts)	7440-02-0	2.4E-03	2.1E-03	9.3E-04	1.9E-03	1.6E-03	7.2E-04	7.8E-04	6.7E-04	3.0E-04	1.9E-03	1.7E-03	7.5E-04	1.9E-03	1.6E-03	7.2E-04
phenanthrene	85-01-8	2.0E-05	1.0E-05	4.6E-07	1.2E-05	6.1E-06	2.8E-07	8.6E-06	4.4E-06	2.0E-07	1.5E-05	7.9E-06	3.5E-07	1.2E-05	6.1E-06	2.8E-07
polychlorinated biphenyls, as PCB-1254	1336-36-3	6.4E-01	1.1E+00	6.1E-02	6.4E-02	1.1E-01	6.1E-03	1.4E-02	2.4E-02	1.3E-03	2.0E-01	3.5E-01	1.9E-02	1.6E-01	2.7E-01	1.5E-02
pyrene	129-00-0	2.4E-05	1.2E-05	5.5E-07	1.2E-05	6.1E-06	2.8E-07	5.2E-06	2.7E-06	1.2E-07	1.3E-05	6.7E-06	3.0E-07	1.2E-05	6.1E-06	2.8E-07
thallium	7440-28-0										3.4E-04	5.8E-03	7.5E-03			
toluene	108-88-3				4.5E-08	2.6E-07	9.2E-10	1.3E-07	7.7E-07	2.8E-09				4.5E-08	2.6E-07	9.2E-10
vanadium	7440-62-2	3.0E-02	5.1E-02	1.0E-02	1.3E-02	2.1E-02	4.3E-03	1.5E-02	2.5E-02	5.1E-03	9.3E-03	1.6E-02	3.2E-03	1.3E-02	2.1E-02	4.3E-03
zinc	7440-66-6	4.3E-04	7.4E-04	3.6E-03	2.2E-04	3.8E-04	1.8E-03	1.0E-04	1.8E-04	8.5E-04	4.2E-04	7.1E-04	3.4E-03	2.2E-04	3.8E-04	1.8E-03
C9-C18 Aliphatics	N/A	6.8E-05	5.9E-05	2.2E-06	2.5E-04	2.2E-04	8.1E-06	9.5E-04	8.1E-04	3.0E-05				2.5E-04	2.2E-04	8.1E-06
C19-C36 Aliphatics	N/A	4.6E-05	4.0E-05	8.9E-06	6.8E-05	5.8E-05	1.3E-05	3.1E-04	2.6E-04	5.9E-05				6.8E-05	5.8E-05	1.3E-05
C11-C22 Aromatics	N/A	7.7E-04	4.0E-04	1.8E-05	1.4E-03	7.4E-04	3.3E-05	4.1E-03	2.1E-03	9.4E-05				1.4E-03	7.4E-04	3.3E-05
Total HI: Route and Expos. Pt.		7.5E-01	1.6E+00	9.9E-02	1.0E-01	2.5E-01	2.7E-02	4.4E-02	1.2E-01	1.1E-02	2.9E-01	8.3E-01	5.2E-02	2.2E-01	4.4E-01	3.6E-02
Proportion of complete exposure point			1.0E+00			1.0E+00			1.0E+00			1.0E+00			1.0E+00	
Adjusted Total HI: Route and Expos. Pt.		7.5E-01	1.6E+00	9.9E-02	1.0E-01	2.5E-01	2.7E-02	4.4E-02	1.2E-01	1.1E-02	2.9E-01	8.3E-01	5.2E-02	2.2E-01	4.4E-01	3.6E-02
Total HI: Expos. Pt.			2.4E+00			3.8E-01			1.8E-01			1.2E+00			6.9E-01	

Formula:

Cumulative HI = $\sum HI_{ingestion\ -\ chemicalspecific} + \sum HI_{dermalcontact\ -\ chemicalspecific} + \sum HI_{inhalation:chemical\ -\ specific}$

HI ingestion-chemical specific = ADD-ingestion-chemical specific x Oral Slope Factor-chemical specific
HI dermal contact-chemical specific = ADD-dermal contact-chemical specific x Oral Slope Factor-chemical specific
HI inhalation-chemical specific = ADE-inhalation-chemical specific x Unit Risk-inhalation-chemical specific

HI = Hazard Index, unitless
ADD = Average Daily Dose, mg/kg/day
ADE = Average Daily Exposure, mg/cu m

Subchronic Oral Reference Dose		X
Chronic Oral Reference Dose		
Subchronic Inhalation Reference Concentration		X
Chronic Inhalation Reference Concentration		

Use capital X to indicate selection

Table 4.2
Calculation of Excess Lifetime Cancer Risk (ELCR) for Exposure to Soil and Dust: Resident, aged 1 to 2 Years

Receptor: Resident, aged 1 to 31 years																	
		Exposure Point:	Courtyard 0-3 Foot Interval			Courtyard 3-6 Foot Interval			Courtyard 6-15 Foot Interval			Stockpiled Fuel Oil Vault Sands SP-3			Derivation of PCB Cleanup Standard		
Chemical Name	CAS Number	Weight of Evidence Class	Dermal Contact	Incidental Ingestion	Dust Inhalation	Dermal Contact	Incidental Ingestion	Dust Inhalation	Dermal Contact	Incidental Ingestion	Dust Inhalation	Dermal Contact	Incidental Ingestion	Dust Inhalation	Dermal Contact	Incidental Ingestion	Dust Inhalation
benzene	71-43-2					8.3E-12	1.6E-10	1.5E-13	1.4E-11	2.8E-10	2.6E-13				8.3E-12	1.6E-10	1.5E-13
benzo(a)anthracene	56-55-3		6.8E-09	5.9E-08	3.7E-10	3.4E-09	3.0E-08	1.9E-10	1.1E-09	9.9E-09	6.2E-11	4.9E-09	4.2E-08	2.7E-10	3.4E-09	3.0E-08	1.9E-10
benzo(a)pyrene	50-32-8		6.2E-08	5.4E-07	3.4E-09	3.1E-08	2.7E-07	1.7E-09	1.1E-08	9.5E-08	6.0E-10	4.2E-08	3.7E-07	2.3E-09	3.1E-08	2.7E-07	1.7E-09
benzo(b)fluoranthene	205-99-2		8.0E-09	6.9E-08	4.4E-10	4.2E-09	3.7E-08	2.3E-10	1.3E-09	1.2E-08	7.4E-11	5.7E-09	5.0E-08	3.1E-10	4.2E-09	3.7E-08	2.3E-10
benzo(k)fluoranthene	207-08-9		2.9E-10	2.5E-09	1.6E-11	1.6E-10	1.4E-09	8.9E-12	6.7E-11	5.8E-10	3.7E-12	2.3E-10	2.0E-09	1.2E-11	1.6E-10	1.4E-09	8.9E-12
beryllium	7440-41-7				4.6E-09			6.3E-09			1.4E-10			9.5E-10			6.3E-09
chlordane	57-74-9					2.1E-10	2.5E-09	4.7E-12							2.1E-10	2.5E-09	4.7E-12
chrysene	218-01-9		7.5E-10	6.5E-09	4.1E-11	3.6E-10	3.1E-09	2.0E-11	1.3E-10	1.1E-09	7.0E-12	4.5E-10	4.0E-09	2.5E-11	3.6E-10	3.1E-09	2.0E-11
dibenzo(a,h)anthracene	53-70-3		1.0E-08	9.1E-08	5.7E-10	6.2E-09	5.4E-08	3.4E-10	4.4E-09	3.8E-08	2.4E-10	9.6E-09	8.3E-08	5.3E-10	6.2E-09	5.4E-08	3.4E-10
DDE	72-55-9		5.3E-11	1.0E-09	2.0E-12												
DDT	50-29-3		1.0E-10	2.0E-09	3.7E-12	3.6E-11	7.0E-10	1.3E-12				1.2E-10	2.4E-09	4.6E-12	3.6E-11	7.0E-10	1.3E-12
dieldrin	60-57-1		1.7E-08	9.6E-08	1.8E-10	5.0E-09	2.9E-08	5.5E-11				3.0E-08	1.8E-07	3.3E-10	5.0E-09	2.9E-08	5.5E-11
dioxin (TCDD equivalents)	1746-01-6		7.7E-08	4.5E-07	6.5E-10	2.3E-08	1.3E-07	1.9E-10	5.0E-09	2.9E-08	4.2E-11	7.2E-08	4.2E-07	6.1E-10	5.5E-08	3.2E-07	4.7E-10
indeno(123-cd)pyrene	193-39-5		3.9E-09	3.4E-08	2.1E-10	1.9E-09	1.7E-08	1.1E-10	7.8E-10	6.8E-09	4.3E-11	2.3E-09	2.0E-08	1.2E-10	1.9E-09	1.7E-08	1.1E-10
nickel	7440-02-0				6.4E-09			4.9E-09			2.1E-09			5.1E-09			4.9E-09
polychlorinated biphenyls	1336-36-3		9.1E-07	5.3E-06	1.8E-09	9.1E-08	5.3E-07	1.8E-10	2.0E-08	1.2E-07	3.8E-11	2.9E-07	1.7E-06	5.6E-10	2.2E-07	1.3E-06	4.3E-10
Total ELCR: Route and Expos. Pt.			1.1E-06	6.6E-06	1.9E-08	1.7E-07	1.1E-06	1.4E-08	4.4E-08	3.1E-07	3.3E-09	4.6E-07	2.8E-06	1.1E-08	3.3E-07	2.1E-06	1.5E-08
Proportion of complete exposure point				1.0E+00			1.0E+00			1.0E+00			1.0E+00			1.0E+00	
Adjusted Total ELCR: Route and Expos. Pt.			1.1E-06	6.6E-06	1.9E-08	1.7E-07	1.1E-06	1.4E-08	4.4E-08	3.1E-07	3.3E-09	4.6E-07	2.8E-06	1.1E-08	3.3E-07	2.1E-06	1.5E-08
Total ELCR: Expos. Pt.				7.8E-06			1.3E-06			3.6E-07			3.3E-06			2.4E-06	

Formula:

Cumulative ELCR = $\sum ELCR_{ingestion-chemicalspecific} + \sum ELCRdermalcontact-chemicalspecific + \sum ELCR_{inhalation:chemical-specific}$

ELCR ingestion-chemical specific = LADD-ingestion-chemical specific x Oral Slope Factor-chemical specific
ELCR dermal contact-chemical specific = LADD-dermal contact-chemical specific x Oral Slope Factor-chemical specific
ELCR ingestion-chemical specific = LADE-inhalation-chemical specific x Unit Risk-inhalation-chemical specific

ELCR = Excess Lifetime Cancer Risk, unit less
LADD = Lifetime Average Daily Dose, mg/kg/day
LADE = Lifetime Average Daily Exposure, mg/cu m

Table 5.1
Calculation of Total Hazard Index (HI): Child Resident, aged 1 Year

Receptor	Child Resident, aged 1 year							Child Resident, aged 1-8 years						
Exposure Point #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pathway:														
Soil Exposure Point:														
Incidental ingestion of soil, normal	1.6E+00	2.5E-01	1.2E-01	8.3E-01	4.4E-01									
Inhalation of dusts from disturbed soil	9.9E-02	2.7E-02	1.1E-02	5.2E-02	3.6E-02									
Dermal contact with soil	7.5E-01	1.0E-01	4.4E-02	2.9E-01	2.2E-01									
Total HI	2.4E+00 Subchronic	3.8E-01 Subchronic	1.8E-01 Subchronic	1.2E+00 Subchronic	6.9E-01 Subchronic									
MCP Non-Cancer Risk Limit	1.E+00	1.E+00	1.E+00	1.E+00	1.E+00									
Does Total HI exceed MCP Non-Cancer Risk Limit?	**Yes**	No	No	**Yes**	No									
Significant Risk of Harm?	**Yes**	No	No	**Yes**	No									

Definition of exposure points							
Exposure Point #	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Soil Exposure Point:	Courtyard 0-3 Foot Interval	Courtyard 3-6 Foot Interval	Courtyard 6-15 Foot Interval	Stockpiled Fuel Oil Vault Sands SP-3	Derivation of PCB Cleanup Standard		

NO SINGLE FAMILY RESIDENCE. NO GARDENING OF EDIBLE PRODUCE.
EXPOSURE TO SOILS OCCURS ONLY DURING A SINGLE SIX-MONTH CONSTRUCTION PROJECT, AFTER WHICH TIME
THE SOILS ARE RETURNED TO EXCAVATION OR ARE TRANSPORTED OFF-SITE.
ASSUMES CONTROLS ARE USED TO LIMIT RESIDENTIAL EXPOSURE TO SOILS DURING CONSTRUCTION PROJECT.
PROTECTIVE COVER MUST REMAIN OVER SOILS EXCEPT DURING CONSTRUCTION OR UTILITY PROJECT, AFTER WHICH TIME THE PROTECTIVE COVER MUST BE RE-INSTALLED.
* PCB CLEANUP STANDARD IS SET AS AN EXPOSURE POINT CONCENTRATION OF 10 MG/KG; THE EXPOSURE POINT CONCENTRATION
IS THE 95TH% UPPER CONFIDENCE LIMIT ON THE MEAN.

Table 5.2
Calculation of Total Excess Lifetime Cancer Risk (ELCR): Resident, aged 1 to 2 Years

Receptor	Resident							Youth Trespasser or Visitor						
Exposure Point #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pathway:														
Soil Exposure Point:														
Incidental ingestion of soil, normal	6.6E-06	1.1E-06	3.1E-07	2.8E-06	2.1E-06									
Inhalation of dusts from disturbed soil	1.9E-08	1.4E-08	3.3E-09	1.1E-08	1.5E-08									
Dermal contact with soil	1.1E-06	1.7E-07	4.4E-08	4.6E-07	3.3E-07									
Total ELCR	7.8E-06	1.3E-06	3.6E-07	3.3E-06	2.4E-06									
MCP Cancer Risk Limit	1.E-05	1.E-05	1.E-05	1.E-05	1.E-05									
Does Total ELCR exceed MCP Cancer Risk Limit?	No	No	No	No	No									
Significant Risk of Harm?	No	No	No	No	No									

Definition of exposure points	Resident						
Exposure Point #	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Soil Exposure Point:	Courtyard 0-3 Foot Interval	Courtyard 3-6 Foot Interval	Courtyard 6-15 Foot Interval	Stockpiled Fuel Oil Vault Sands SP-3	Derivation of PCB Cleanup Standard		

NO SINGLE FAMILY RESIDENCE. NO GARDENING OF EDIBLE PRODUCE.
EXPOSURE TO SOILS OCCURS ONLY DURING A SINGLE SIX-MONTH CONSTRUCTION PROJECT, AFTER WHICH TIME THE SOILS ARE RETURNED TO EXCAVATION OR ARE TRANSPORTED OFF-SITE.
ASSUMES CONTROLS ARE USED TO LIMIT RESIDENTIAL EXPOSURE TO SOILS DURING CONSTRUCTION PROJECT.
PROTECTIVE COVER MUST REMAIN OVER SOILS EXCEPT DURING CONSTRUCTION OR UTILITY PROJECT, AFTER WHICH TIME THE PROTECTIVE COVER MUST BE RE-INSTALLED.
* PCB CLEANUP STANDARD IS SET AS AN EXPOSURE POINT CONCENTRATION OF 10 MG/KG; THE EXPOSURE POINT CONCENTRATION IS THE 95TH% UPPER CONFIDENCE LIMIT ON THE MEAN.